MACHINERY

Design—Construction—Operation

Volume 43 **MAY, 1937** **Number 9**

June MACHINERY will contain a wide variety of subjects of interest to the executive, the designer, and the shop man. Among the articles will be: "Is Decentralization Practical in the Metal-Working Industry?" (based on Henry Ford's experience in establishing shops in rural communities); "Rolling One-Piece Finned Tubing;" "Hydraulic Operation of Machine Tools;" "Trade Training in a Machine Tool Plant;" prize articles on "Paying Investments in New Equipment." In addition there will be, as usual, articles on ingenious mechanisms, jig and fixture design, and new shop equipment.

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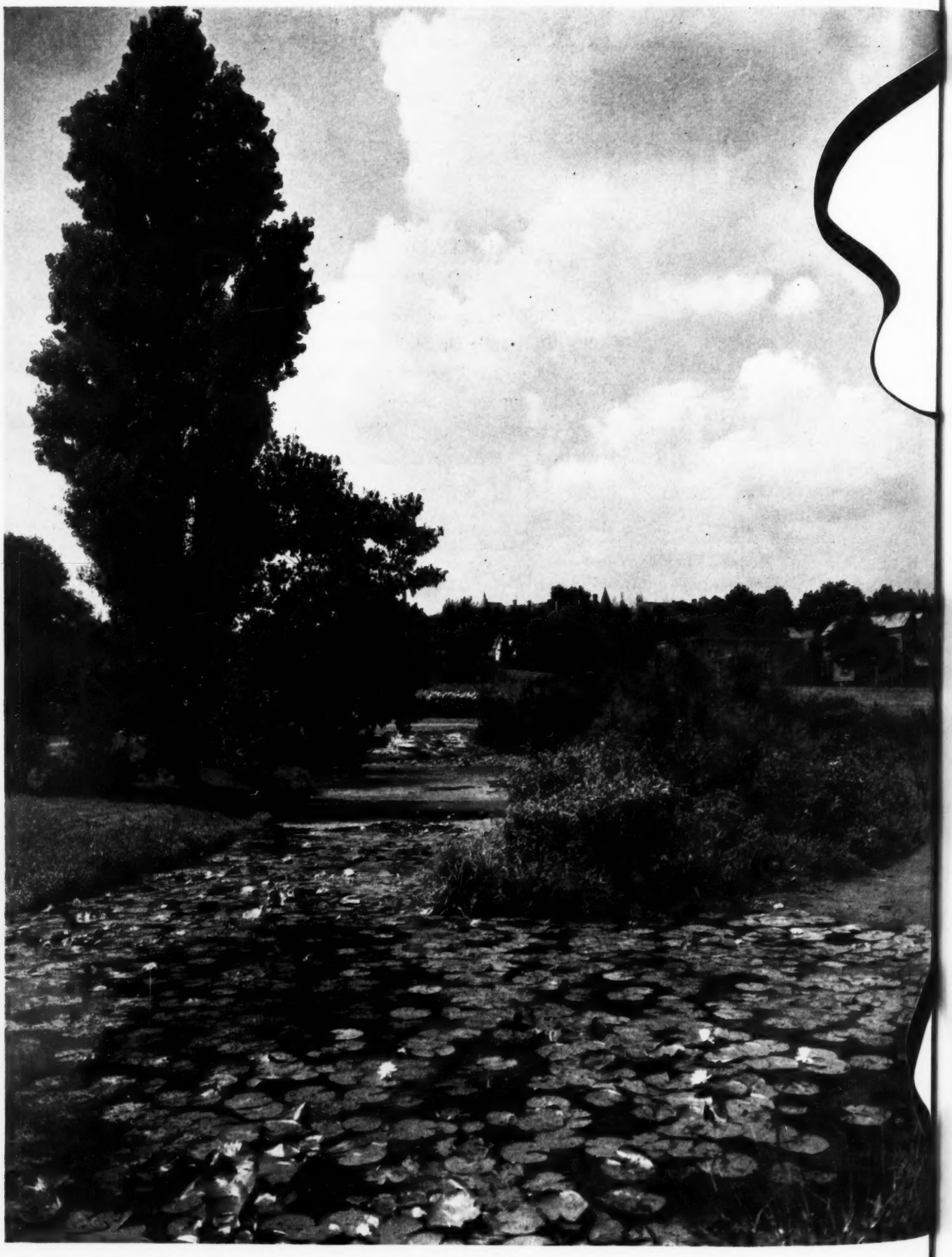


MACHINERY

Volume 43 NEW YORK, MAY, 1937 Number 9

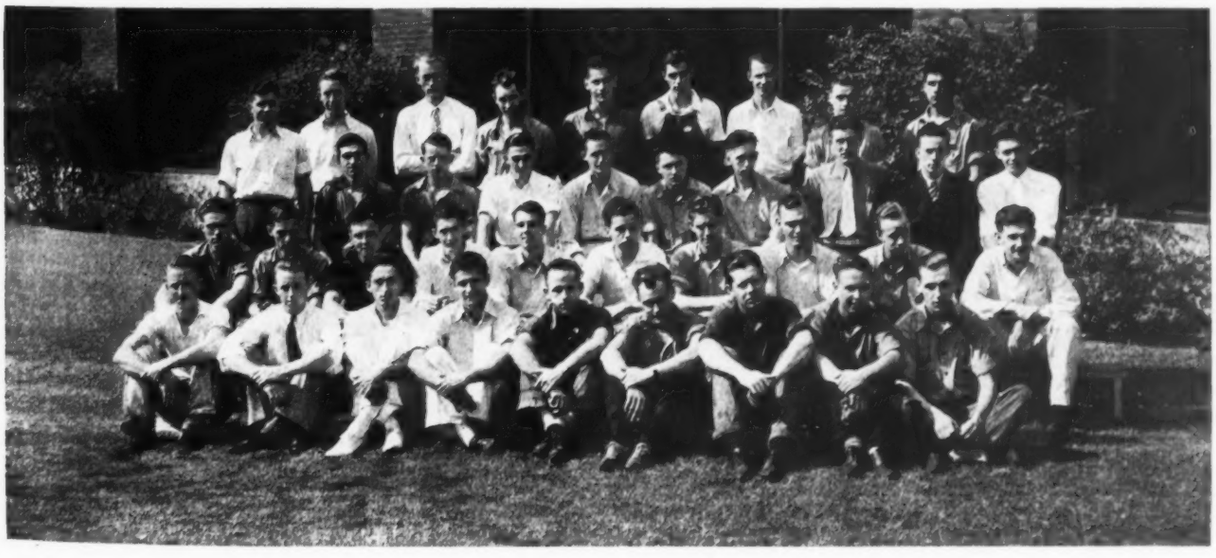
Are Modern Apprentice Systems Successful?

The Caterpillar Tractor Co. Answers this Question by an Emphatic "Yes." For Many Years, this Company has Operated Very Extensive and Highly Developed Training Courses with Outstanding Success

By K. P. CROWELL
Supervisor of Plant Training
Caterpillar Tractor Co., Peoria, Ill.

FREQUENTLY we hear manufacturers say that one cannot operate an apprentice system successfully today; that the modern production shop is not suitable for apprentice training; that the present-day American boy does not want to learn the machinist's, patternmaker's, or molder's trade—he wants a white-collar job; that the cost of operating an apprentice system is prohibitive in the average plant; that, when trained, the young men leave you anyway and you do not get the benefit of their training; and that, all in all, it just "cannot be done." When that conclusion has been reached, as a rule, nothing is done.

Eighteen years' experience with apprentice training courses at the plants of the Caterpillar Tractor Co. disproves every one of these contentions. This company has operated machinists', patternmakers' and molders' apprentice courses for many years; and even before the present courses were organized along more modern lines some eight or ten years ago, apprentices were being trained, many of whom are now holding executive and supervisory posi-



The Foreman, Himself a Former Apprentice Graduate, Giving One of the "Caterpillar" Apprentices a Few Pointers on Applying the Micrometer

tions in the company's plant. The factory manager of the Tractor Division, for example, is one of the company's apprentice graduates.

It will be admitted, however, that no apprentice system will succeed if planned in a hasty, haphazard manner and operated carelessly and unsystematically. The apprentice system requires just as much concentrated thought, careful attention, and continuous supervision as any other function of a machine-building plant. Furthermore, the selection of the boys entering the course is of the greatest importance.

Possibly one of the most direct causes of failure of some apprentice systems has been the lack of care in selecting boys for training. The effect of careful selection is usually evidenced by the percentage of the apprentice boys that finally graduate. In the early years of this company's apprentice courses, only a comparatively small percentage of the boys graduated—say, from 15 to 20 per cent. Gradually, as greater care was taken in selecting the boys and more experience gained in handling the system, this figure was raised to 30 per cent. At present, 90 per cent of those who have started the apprentice training will no doubt graduate, and this in spite of the fact that the requirements have been made more exacting.

For entrance in the training courses, high-school graduation or equivalent education is required. While the actual rules laid down for entrance in the course do not necessarily call for high-school graduation, it has become the practice to expect boys to graduate from high-school before being accepted in the course. The more thorough their preliminary education has been, the more satisfactory they are likely to be in their shop work. Furthermore, the course is not intended to merely train machinists or molders; the young men being trained are some day expected to fill supervisory or executive positions in the plant.

The accepted boy is not placed immediately in the apprentice course. He is first required to serve a probationary period of 1040 working hours, which is the equivalent of six months. If, after this probationary period, he is deemed satisfactory material for training, he is accepted for the regular apprentice course, either of four years for machinists and patternmakers, or three years for molders.

The company also maintains what is known as a production apprentice course, which covers a period of two years, including the probation time. This course, which comprises complete training in the operation of four different types of machine tools —as, for example, drilling machines, milling machines, turret lathes, and grinding machines—is not intended to make all-around machinists, but to train capable machine operators, fully versed in the operation of at least four different types of machines. At the present time, there are about 250 men on the waiting list for this course. Men already working in the plant are selected for this course. So many of the company's employes have made application for this training, and additional applications are constantly being received, that it is not believed that it will be necessary to take anyone from outside the Caterpillar organization for this training course.

During the apprentice course, the boys work forty hours a week, of which thirty-seven hours are spent in regular shop work and three hours in a classroom where shop mathematics, trigonometry, drawing, physics, and chemistry are taught. No effort is made to include civic subjects. It is believed that a proper civic spirit is better instilled by providing good surroundings, satisfactory working conditions, and reasonable pay. These factors, together with a friendly interest in the boys' problems, will develop a civic spirit far better than mere talks on good citizenship. An effort is made, however, to maintain an active interest in athletics, and the apprentices have very good athletic teams.

In answer to the objection that the American boy does not want to learn the machinist's trade, but is looking for a white-collar job, it is of interest to record that, at present, there is a waiting list of about 100 for the machine shop four-year apprentice course. These boys come largely from the local high-schools; but they are recruited to some extent from other parts of the country as well, and, at the present time, several states are represented among the young men enrolled in the apprentice course.

The question whether apprentices will stay with the firm where they had their training is one that the Caterpillar Tractor Co. can answer emphatically in the affirmative. In fact, the figures demonstrating this are so favorable that at first it might be thought that an error has been made in recording them. The writer, therefore, wishes to emphasize their accuracy. Out of 175 recent apprentice graduates, 173 are still working for the company. Of the two that have left, one is now a senior in the George Washington University, and the second is assistant to the Secretary of Public Utilities in Newfoundland.

The Best Incentive is the Knowledge that the Apprentice Has a Future in the Plant

Obviously these results can be obtained only when it is evident to the graduates that they have a future in the plant. It is part of the system to seek constantly to place the graduates in suitable positions in the shop and to give them a chance for promotion. If the younger men see that former graduates are gradually occupying supervisory positions, it stimulates the interest in their work, and it makes them eager to stay with the company that fosters loyalty in their apprentices by being loyal to them.

The question of cost is one that has troubled many manufacturers who have had no previous experience with apprentice systems. The Caterpillar training courses are thoroughly self-supporting, yet the boys' compensation is very satisfactory; and in the last six months' period of training, many of them earn journeymen's wages. Their average compensation during the entire period is approximately 62.5 per cent of the regular journeyman machinist's wage.

In addition to the regular apprentice training courses, the company also maintains a two-year course for university graduates who have completed either engineering or commercial courses. These men are generally selected by visiting various colleges toward the end of the college year and interviewing the prospective graduates, with a view to offering an opportunity for training to those who seem to suit the activities of the company.

The Facts Speak for Themselves

The extent of the training courses may be judged from the fact that, at present, there are in the company's employ approximately 370 machinist apprentices, besides 100 production machinist, 50 molder, and 10 patternmaker apprentices. There are also about 40 college graduates in the two-year advanced training course.

In view of the facts quoted, the writer believes that the question as to the success of modern apprentice systems can be answered in the affirmative on every point that has been brought up. However, let it again be emphasized that no apprentice system will prove a success if it is not carefully and conscientiously planned, and given the same attention as any other department of a company's activities.

The experience of the Caterpillar Tractor Co. has been that the young men of today respond enthusiastically to the opportunity of training for their responsibilities in life, and that all that is necessary is to provide them with the opportunity.

Individual Instruction is Stressed in the "Caterpillar" Apprentice School—The Supervisor of Apprentice Training Working out a Problem on the Drawing-board with an Apprentice

The Hydraulic Operation of Machine Tools

Feeding and Traversing Movements of Grinding Machines and Lathes Obtained through Automatically Controlled Hydraulic Units—First of a Series of Articles

DEMANDS for higher speeds and feeds, greater precision, easier and more flexible control, and other features designed to increase the efficiency of machine tools have been largely responsible for the increase in the use of hydraulic operating equipment. The rapid progress made in this country in the development of hydraulically operated machine tools has been recorded monthly in the Shop Equipment News section of MACHINERY. Similar progress made in Great Britain and elsewhere in Europe will be described in this and succeeding articles. Since European practice is described, the illustrations are made in the first-angle projection instead of the third-angle projection as used in this country.

Stepless changes in speed or feed throughout a wide range of adjustment, shockless reversal, quiet operation, and low power consumption are advantages of hydraulic systems. These systems, consisting of self-contained pumping and valve units, are now available for use on practically all types of machine tools. Although they are commonly called hydraulic systems, no water is employed, the operating fluid being oil, which not only provides means for the hydraulic transmission of power, but also serves to lubricate the moving parts.

The use of oil for transmitting power or movement to machine tables, slides, feeds, etc., has several advantages. The incompressibility of oil prevents the generation of heat and loss of energy from this source. The chemical stability of oil, its non-corrosive nature, and its lubricating properties are important advantages.

All oil-pipes must be air-tight, as air in the system will result in the generation of heat and loss of energy. For this reason, all exhaust pipes should enter the return tank below the oil level. The accumulation of air can be prevented by having the supply tank open to the atmosphere and mounted at the highest point—that is, above the rest of the hydraulic system. Another method of avoiding trouble from the entrance of air in the pipes is the provision of air drains in the circuit. The cushioning effect of an oil system is due to the slight leakage of oil past the acting or actuated pistons or members, and is not due to the compressibility of the oil, which is practically zero.

The valve-gear must be so designed as to permit instant reversal, and the range of speed adjustment must be wide and operate under all conditions of feed, rapid traverse, and reverse without vibration, shock, or overheating of the oil. A variable-delivery pump which can be adjusted quickly to any desired forward or reverse speed or feed positions, or to the stop or neutral positions, greatly simplifies the design of the controlling valve. The design of the controlling valve or valves is more complicated in systems using a constant-delivery pump.

With the constant-delivery pump, the oil under pressure must be quickly cut off, so that stopping or reversing will be accomplished by the valve mechanism alone. This requires a relief valve, so that under normal feeding conditions, power will be consumed in pumping surplus oil through the relief valve back to the tank, thus causing the oil temperature to rise and necessitating a larger tank.

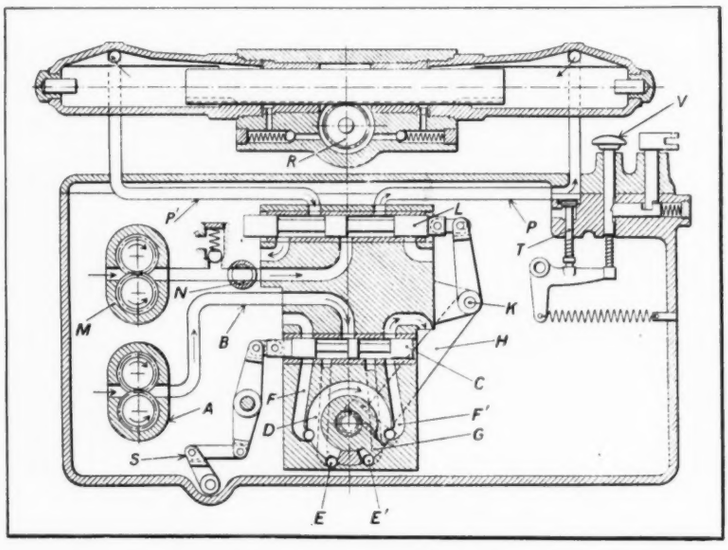


Fig. 1. Hydraulic Table Traverse and Feed-control Circuit for Internal Grinder

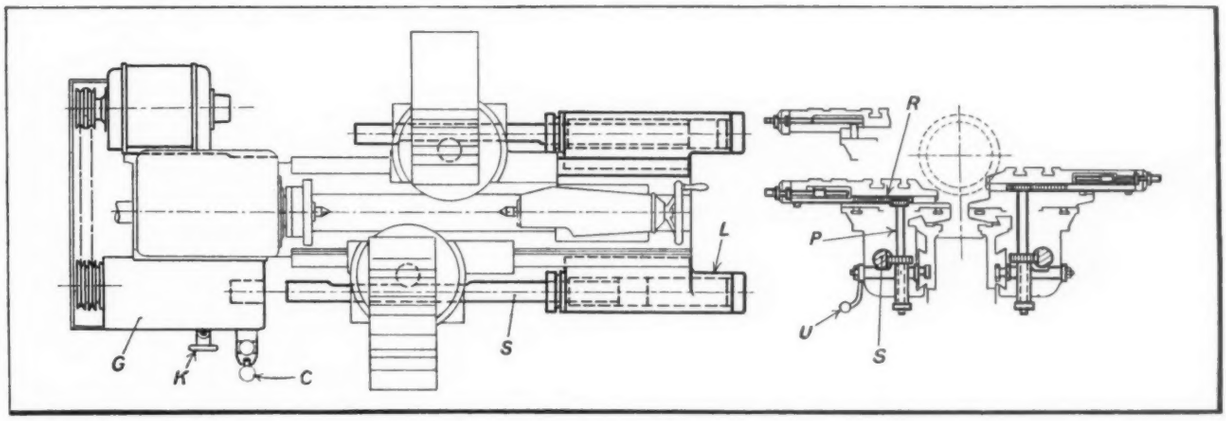


Fig. 2. Plan and Sectional Views of Hydraulic Multi-cut Lathe

Rapid traverse can be obtained with this arrangement, however, by directing the surplus oil to the cylinder. The surplus oil can also be used to operate hydraulic clamping fixtures, jigs, and supplementary traverse movements by designing the control valve for this purpose.

Hydraulic Table Traverse and Feed Control for Internal Grinder

The hydraulic table traverse and feed-control circuit of an automatic internal grinder of the reciprocating table type built by Carl Jung, Berlin, Germany, is shown in Fig. 1. The automatic cycle of this machine comprises roughing, wheel-dressing, adjustment of the slide for wheel wear, and finishing. After the final size is reached, the machine stops automatically. The work headstock, wheel-spindle, and hydraulic pump are independently driven by push-button controlled motors. The hydraulic drive is of the two-pump type, designed to give uniform traverse and shockless reverse of the table and accurate operation of the transverse feed movement. The hydraulic circuit is shown diagrammatically in Fig. 1. The gear pumps and the control valves are housed in an enclosed box and are permanently submerged in oil.

The oil delivered from the pump *A* through pipe *B* is admitted by the auxiliary piston-valve *C* into the circular passage *D* by one of the pipes *E* or *E'*, and is exhausted through pipe *F* or *F'*. In passage *D* is a vane type piston *G* connected to a pinion, which, through a gear segment and lever *H*, pivoted at *K*, moves the main control piston *L*. Through intermediate gearing and shafting, the piston *G* also controls the transverse movement of the cross-slide or the feed adjustment of the grinding wheel.

The second pump *M* supplies oil through a regulating valve *N* to the piston-valve *L*, whence it is supplied to the main cylinder through pipe *P* or *P'*, depending on the position of the valve. Rack teeth on the main piston mesh with the pinion *R* for traversing the table. The table traverses at twice the piston speed and is reversed by stops which operate the valve lever *S* linked to the control piston *C*. The trip valve *T*, which brings the table to rest at the right-hand end of the stroke, is opened either manually, by withdrawing the knob *V*, or automatically from the cross-slide or wheel-feed adjustment.

Hydraulic System for Operating Front and Rear Slides of Multi-Cut Lathe

The movements of the front and rear tool-slides of the multi-cut lathe shown diagrammatically in Fig. 2 are controlled by the hydraulic circuit shown in Fig. 3. This lathe has been developed by F. A. Scheu, Berlin, Germany, for turning light cast-iron or steel parts on a production basis, and also for machining bronze and light metals, using cemented-carbide or diamond tools. The feed of the two-pump Heller system of this machine is positively adjusted and is designed to remain constant, independent of the oil temperature and feed pressure.

Each unit consists of a gear pump feeding a pressure-relieved variable-delivery metering pump which supplies an accurately controlled volume of oil to the operating cylinder. The feed for each slide is provided by the movement of the piston in the main cylinder *A*, Fig. 3, the direction of the movement and the slow or rapid traverse motions being controlled by the piston *B* operated by the hand-lever *G*. The latter has four positions corresponding to rapid traverse forward, feed, stop, and rapid return. The gear pump *D* takes the oil from the sump, passing it to the control piston *B* and simultaneously to the variable-delivery pump *E* and the pressure compensating valve *F*.

The adjusted spring pressure of the latter valve determines the maximum oil pressure in a cylinder during the idle motions. With the control piston in the feed position, the oil is fed to the right-hand end of the cylinder *A* from the delivery side of the pump *E*, which is also connected to the chamber behind the piston of the pressure compensating valve *F*. Oil is also free to enter the left-hand end of cylinder *A* through the annular groove in the control valve cylinder.

If the working resistance encountered by the feed piston increases while the machine is in operation, the pressure existing in the right-hand end of cylinder *A* behind the piston, and in the rear chamber of the compensating valve will increase. Therefore, the gear pump must generate a correspondingly higher pressure before opening the compensating valve and by-passing the oil into the sump. The same pressure is applied to the suction and delivery side of the variable-delivery pump, with the result that the pressure on the pump is balanced. Both sides of the main feed piston are also exposed to the same pressure, so that the piston operates against a controlled back pressure and the slide moves forward uniformly.

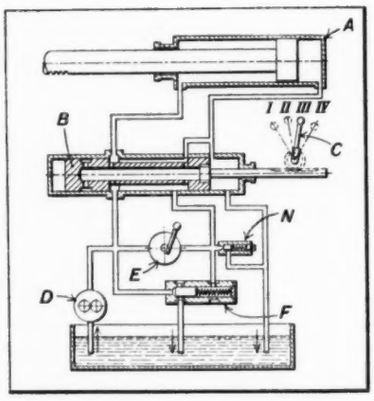


Fig. 3. Arrangement of Hydraulic-feed Circuit of Lathe Shown in Fig. 2

The hydraulic unit *G*, at the front of the machine below the headstock, Fig. 2, is driven through V-belts from a separate motor mounted on the bed at the back of the machine. The two short feed-control levers *C* may be coupled together to control the two slides simultaneously. The feed rates are varied from 0 to about 23 inches per minute by means of the two small handwheels *K*. These control the output from the variable-delivery pumps, the adjusted feeds being indicated on scales.

The operating cylinders *L* for the front and rear slides are bolted to each side of the bed below the tailstock, the working pressure in each cylinder being indicated by pressure gages. Adjustable relief valves *N*, Fig. 3, incorporated in the two systems of piping serve automatically to reduce the feed rate to accommodate a cut of increasing resistance. A hydraulic work-clamping fixture may be operated from the hydraulic system, which, in that case, must be modified to include an adjustable preloading valve between the gear and control pumps, so that even in the stop position of the feed control valve *B*, there will be sufficient pressure available for clamping.

Both the front and rear saddles run on V-guides on top of the bed, with additional dovetailed guides on the front and rear sides. The cross-slide base, locked to the top face of each saddle, may be pivoted about a vertical axis. This axis of rotation coincides with that of the vertical shaft *P*, Fig. 2, housed in the saddle casting. Two pinions, mounted at the upper and lower ends of this shaft, mesh with two racks, the upper rack *R* being adjustably attached to the cross-slide, while the lower rack is integral with the extension *S* of the piston-rod. By swiveling the cross-slide base and setting it at a suitable angle, bevel facing and taper turning can be carried out without the aid of special attachments. All the feed movements are limited in both

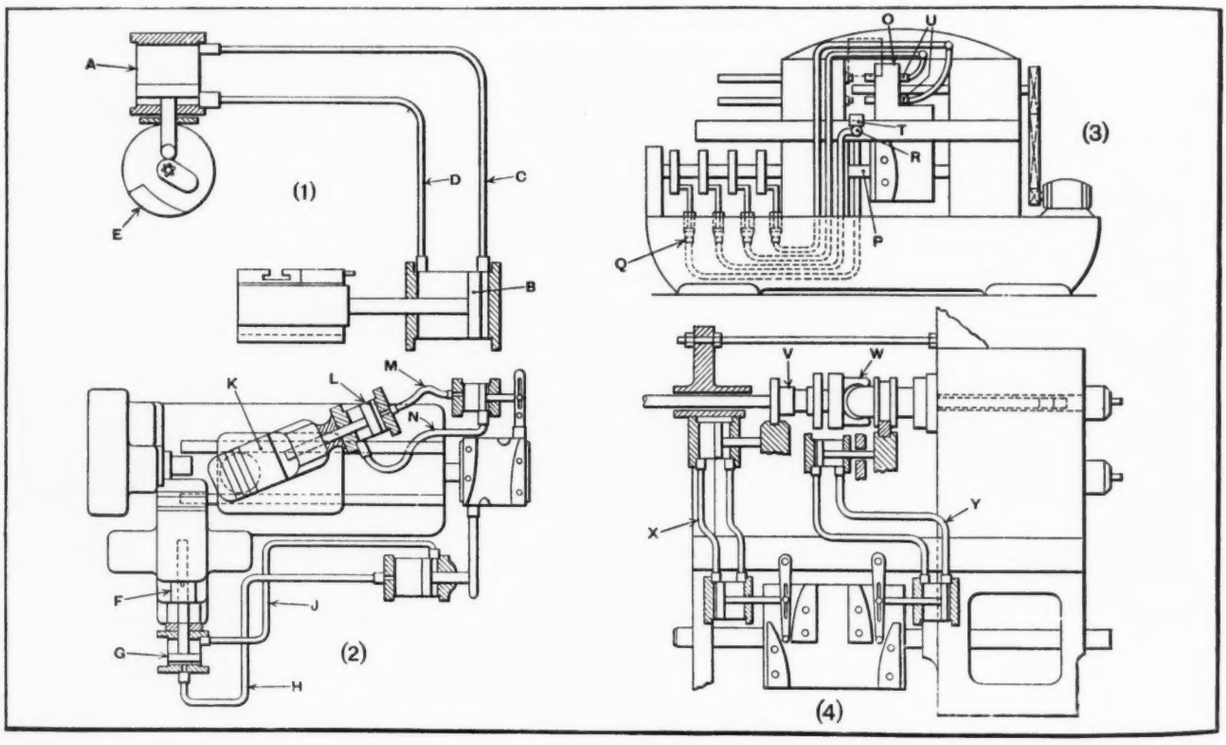


Fig. 4. Closed-circuit Hydraulic System for Controlling Lathe Slide Movements

directions by stop-dogs which are provided with means for making fine adjustments.

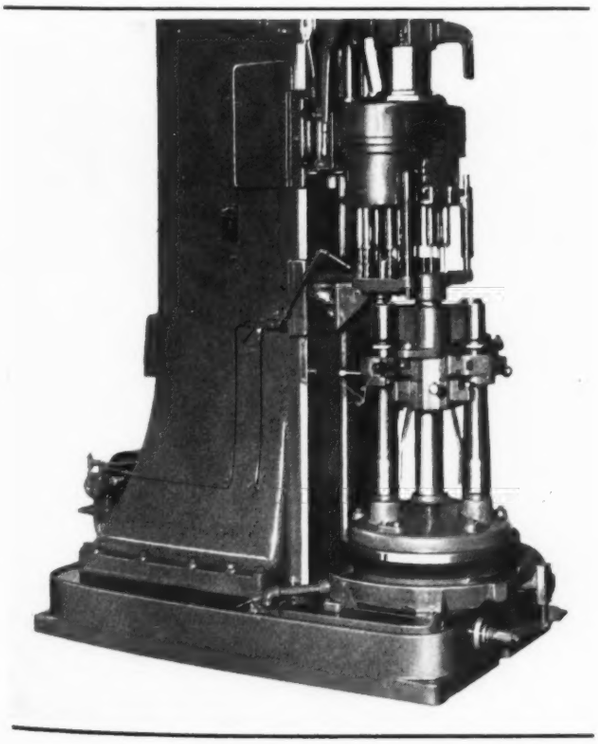
Closed-Circuit Hydraulic System for Lathe Control

A system patented by Paul von Pechmann, Cologne, Germany, employs separate or double-acting oil linkages for each movement of the lathe slides instead of the customary pump drives. With this system, every part has its own driving cylinder, the piston of which can be operated from a common shaft or cam. Four views of this driving system are shown diagrammatically in Fig. 4. Diagram (1) shows a double-acting fluid linkage consisting of two pistons *A* and *B* connected by pipes *C* and *D*. Partial rotation of cam *E* causes piston *A* to force oil through pipe *C*, driving the piston and the connected slide to the left, until on further rotation, the piston *A* is drawn back by section *E* of the cam, transferring the oil through pipe *D* and returning the piston *B* and the tool-slide. This closed circuit requires suction valves and make-up lines to prevent the loss of oil.

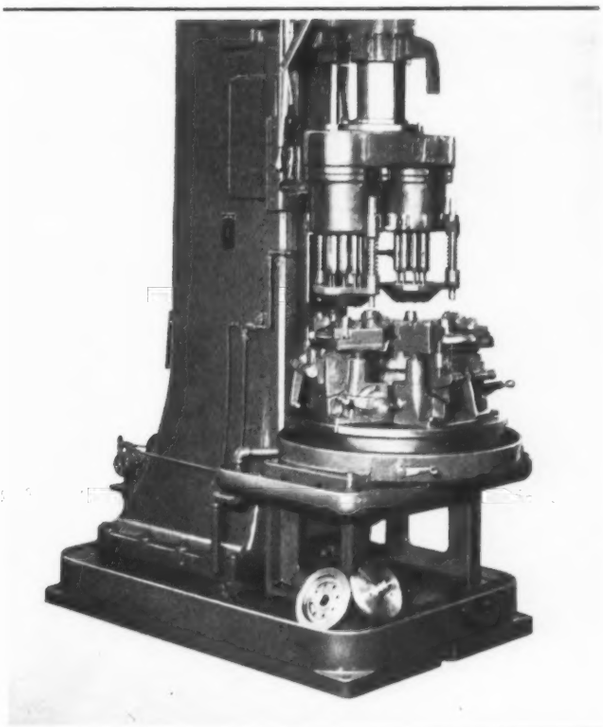
The application of the device to a semi-automatic lathe is shown in diagram (2). The cross-slide *F*, mounted on the bed, is actuated by the piston *G* through the fluid columns in pipes *H* and *J*, while the longitudinal slide *K*, pivoted on a second slide, is operated by the piston *L* and the fluid columns in the flexible connections *M* and *N*. The reciprocation of the pistons is controlled by the cams, which are interchangeable and can be adjusted as required.

In diagram (3) is shown an application of the system to a full-automatic lathe. The longitudinal slide *O* on the upper part of the bed is reciprocated by the cam-drum driven from shaft *P*. On this shaft are mounted a series of cam disks which operate pistons *Q*. These pistons actuate the pistons in cylinders *R* which traverse the cross-slides, one of which is shown at *T*, while the pistons in the cylinders *U* move the tools in the slide *O* through flexible connections. Further applications of this system are shown in diagram (4). These include the bar feed motion *V* and clamping mechanism *W*, which are operated by cam motion through fluid linkages at *X* and *Y*.

Hydraulic Feed and Return Movements of a Multiple-spindle Head Facilitate the Drilling and Reaming of Seven Holes in the Flange of Automobile Rear-axle Housings. The Drilling is Done at the First Station, Reaming at the Second, and Loading at the Third. The Machine is of the Hydram Type, Built by the Barnes Drill Co., Rockford, Ill.



A High-speed Drilling and Reaming Operation on a Barnes Hydram Machine Equipped with Two Multiple-spindle Heads and a Three-station Hand-indexed Table. The Work is a Steel Forged Automobile Differential Part. A Device Attached to the Table Pushes All Chips Around the Trough to an Opening in the Rear, through which They are Discharged



Improving the Product with Air-Conditioned Test Rooms

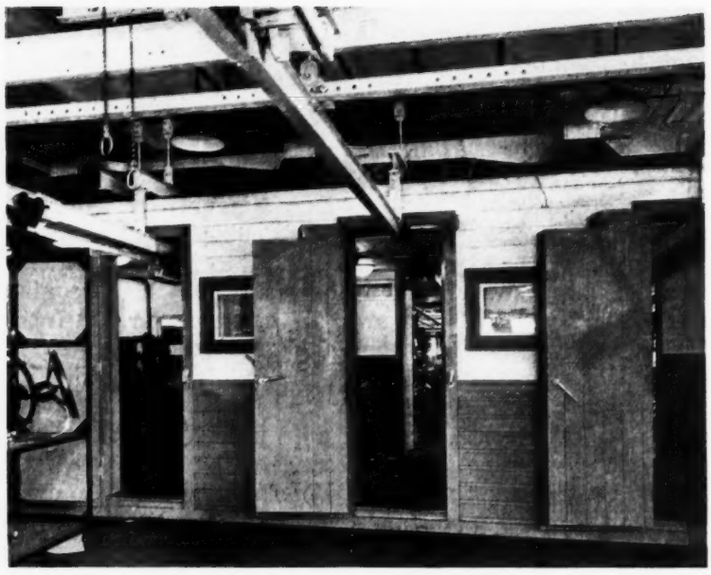


Fig. 1. An Air-conditioned, Sound-proof Testing Room at the Westinghouse East Springfield Plant, Equipped for Testing Electrical Products

AIR-CONDITIONED testing departments, designed to insure greater accuracy and more comfortable working conditions for the operators, are being used with excellent results in the appliance manufacturing plant of the Westinghouse Electric & Mfg. Co. at East Springfield, Mass. One of the important operations to which completed appliances such as fans, food mixers, and vacuum cleaners must be subjected is the final test. This test is made to insure quiet operation and mechanical and electrical efficiency. In order to provide the most favorable conditions and eliminate outside interference, the test booths are air-conditioned and sound-proofed.

Sound-proof booths that required ventilation have been in use for some time. The ventilation of these booths was taken care of by the addition and proper circulation of fresh air; but in this system, no means were provided for the removal of heat created by the appliances, and often the temperature rose to an uncomfortable degree. The necessity for the thorough conditioning of this air became apparent.

At the present time, operators are working under ideal air conditions in these booths. The temperature is controlled and maintained at a comfortable point, regardless of outside conditions, and with no sacrifice of sound-proofness. This has been accomplished by means of a central conditioner and a distributing duct system, which takes care of several test booths. The duct is lined with a sound-absorbing material, and is connected to the test booths by means of canvas connectors.

These features reduce to a minimum the transmission of noise from the fan and other sources to the inside of the booth. The system is designed so that all the air can be recirculated or else partly recirculated and air added in any desired proportions. Since these installations have been made, it has been found that the operators are more alert and better fitted to conduct the tests.

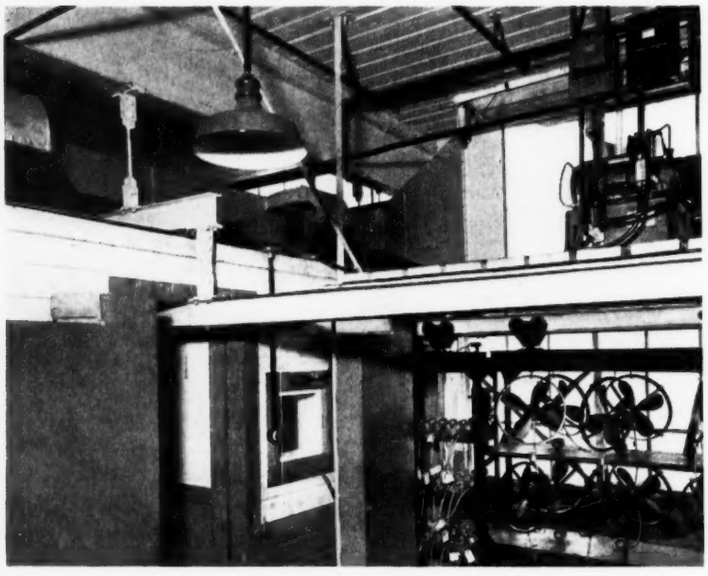


Fig. 2. Conveyor Rack Loaded with Electric Fans to be Tested in Air-conditioned Room. On the Upper Platform is the Hermetically Sealed Condensing Unit for Cooling the Testing Room

* * *

The great question in our country today is not hours of employment, nor rate of pay, nor rights of labor and management. These questions have always been solved in an American way—they will be solved that way again. The great question confronting us is: Are we to continue to live by law and order and a tradition that we call American, or shall we, too, cut our anchors and join the long line of men elsewhere, who were determined to live by force, and who have been living under it ever since?—*From The Shaft, published by Summerill Tubing Co.*

MACHINERY'S DATA SHEETS 345 and 346

TYPICAL PROPERTIES OF ANNEALED AND HEAT-TREATED CAST STEELS—1

Sivyer Steel Casting Co.'s Practice

Kind of Steel (For Composition, See Data Sheet No. 346)	Tensile Strength, Pounds per Square Inch	Yield Point, Pounds per Square Inch	Elongation in Two Inches, Per Cent	Reduction of Area, Per Cent	Brinell Hardness
High-Carbon Steel (a)		Full-Annealed			
	80,000	45,000	20.0	30.0	179
		Properties Obtainable by Heat-Treatment			
	85,000 to 150,000	55,000 to 90,000	20.0 to 3.0	35.0 to 4.0	175 to 400
Manganese-Nickel Steel (b)		Normalized and Drawn			
	90,000	55,000	24.0	45.0	187
		Properties Obtainable by Heat-Treatment			
	80,000 to 165,000	55,000 to 150,000	30.0 to 8.0	60.0 to 20.0	180 to 415
Manganese-Vanadium Steel (c)		Normalized and Drawn			
	95,000	65,000	25.0	52.0	197
		Properties Obtainable by Heat-Treatment			
	95,000 to 180,000	70,000 to 165,000	28.0 to 8.0	60.0 to 25.0	190 to 415
Chromium Steel (d)		Full-Annealed			
	95,000	55,000	18.0	25.0	207
		Properties Obtainable by Heat-Treatment			
	100,000 to 200,000	70,000 to 165,000	19.0 to 3.0	35.0 to 4.0	200 to 500
Chrome-Nickel Steel (e)		Normalized and Drawn			
	100,000	65,000	20.0	35.0	217
		Properties Obtainable by Heat-Treatment			
	115,000 to 210,000	85,000 to 173,000	18.0 to 6.0	43.0 to 10.0	225 to 550
Chrome-Nickel-Molybdenum Steel (f)		Normalized and Drawn			
	110,000	85,000	20.0	40.0	255
		Properties Obtainable by Heat-Treatment			
	125,000 to 245,000	90,000 to 190,000	20.0 to 8.0	50.0 to 10.0	250 to 600

MACHINERY'S Data Sheet No. 345, New Series, May, 1937

TYPICAL PROPERTIES OF ANNEALED AND HEAT-TREATED CAST STEELS—2

Sivyer Steel Casting Co.'s Practice

Kind of Steel (For Composition, See Table Below)	Tensile Strength, Pounds per Square Inch	Yield Point, Pounds per Square Inch	Elongation in Two Inches, Per Cent	Reduction of Area, Per Cent	Brinell Hardness
Dynamo Steel* (Normalized) (g)	55,000	35,000	30.0	60.0	120
5 Per Cent Chromium, 0.5 Per Cent Molybdenum Steel† (Normalized and Drawn) (h)	105,000	80,000	20.0	45.0	229
No. 60 18 Per Cent Chromium, 9 Per Cent Nickel‡ (Quenched from 2000 Deg. F.) (i)	75,000	40,000	50.0	50.0	156
No. 64 27 Per Cent Chromium, 10 Per Cent Nickel§ (Quenched from 2000 Deg. F.) (j)	95,000	40,000	25.0	25.0	197

*This steel has a high magnetic permeability. It is well suited for electrical parts. Because of its low carbon content, it cannot be materially hardened by quenching.

†This is a special-purpose steel and is generally used in the normalized and drawn condition.

‡This is a steel having resistance to corrosion and heat. The tensile properties of this steel are not materially changed by heat-treatment.

§This is also a corrosion- and heat-resistant steel; its tensile properties are not materially affected by heat-treatment.

Typical Composition of Sivyer Cast Steels, Per Cent

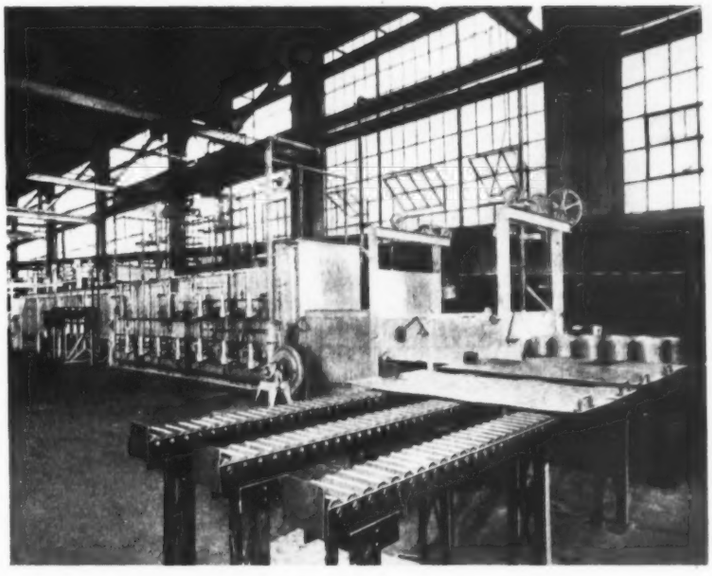
	Carbon	Manganese	Silicon	Chromium	Nickel	Vanadium	Molybdenum
High-Carbon Steel (a)	0.45	0.75	0.40	—	—	—	—
Manganese-Nickel Steel (b)	0.35	1.10	0.40	—	0.75	—	—
Manganese-Vanadium Steel (c)	0.35	1.40	0.40	—	—	0.10	—
Chromium Steel (d)	0.40	0.75	0.40	0.90	—	—	—
Chrome-Nickel Steel (e)	0.40	0.75	0.40	0.90	1.75	—	—
Chrome-Nickel-Molybdenum Steel (f)	0.35	0.75	0.40	0.75	1.75	—	0.25
Dynamo Steel (g)	0.10	0.10	0.20	—	—	—	—
5 Per Cent Chromium, 0.5 Per Cent Molybdenum Steel (h)	0.20	0.70	0.40	5.00	—	—	0.50
No. 60 18 Per Cent Chromium, 9 Per Cent Nickel (i)	0.10	0.50	1.00	18.50	9.00	—	—
No. 64 27 Per Cent Chromium, 10 Per Cent Nickel (j)	0.20	0.50	1.00	27.00	10.00	—	—

MACHINERY'S Data Sheet No. 346, New Series, May, 1937

Equipment for Annealing Copper Without Oxidation

THE resistance of copper to corrosion at atmospheric temperature has led to widespread and diversified applications of this material. When heated to a temperature of about 500 degrees F., however, copper oxidizes easily when exposed to air. This characteristic is of little concern to the ordinary user, but to the manufacturer of copper products it is of the utmost concern, and is a source of considerable expense.

Copper, although relatively soft, is hardened by cold-working. In processing copper, considerable cold-working is required, which leaves the metal hard. It is, therefore, necessary to anneal copper at various intermediate stages. This annealing usually requires a temperature around 1000 degrees F. When copper at this temperature is exposed to air, it scales readily, and it is necessary to remove the scale before further processing or before placing the product on the market.



Gas-fired Annealing Furnace and Equipment Designed to Anneal 3000 Pounds of Copper Products per Hour without Oxidation

While the scale can be easily removed by pickling with acid, a considerable expenditure is involved in providing the necessary vats, acid, and labor, not to mention the loss of copper through scaling. These difficulties have been overcome, however, by the development of annealing furnaces and equipment in which the manufacturer can anneal his copper products without the formation of any scale. Copper products leave these annealing furnaces with a bright and sales-appealing luster. Such furnaces have been in use for several years. The one shown in the accompanying illustration was designed, fabricated, and installed by the Surface Combustion Corporation, Toledo, Ohio, for use in the Detroit plant of a large copper and brass manufacturer.

This furnace is gas-fired and the work is surrounded at all times by specially prepared atmosphere which prevents scaling or oxidation. This atmosphere is prepared in a so-called DX unit by cracking coke oven gas in a refractory-lined chamber. The resultant products are refined and a final gas is obtained which is non-explosive, clean, free from oxygen, and dehydrated. It is composed principally of five constituents—nitrogen, carbon dioxide, hydrogen, carbon monoxide, and methane.

Naturally, the products of combustion from the gas used to heat the furnace cannot be allowed to come into contact with the special atmosphere gas, nor can air be allowed to leak into the furnace, as it would have a scaling effect. For the larger furnaces, a metal muffle is not very satisfactory from the viewpoint of initial cost and deterioration. All of the advantages of a muffle, as well as several additional advantages, are obtained by means of gas-fired radiant tube heating elements of the type described in February MACHINERY, page 373. This heating unit is mounted through the side walls and is located over and under the conveyor. Both ends of the U-shaped heating tube are located outside the furnace. The heating gas is burned entirely within these tubes, and the products of combustion, consequently, never come in contact with the work.

The entire furnace, or more properly the unit, consists essentially of a heating chamber, a cooling chamber, and an atmosphere preparation unit. The capacity of this furnace is 3000 pounds per hour. The coils of work are loaded uniformly on trays or pans, so as to secure a normal loading of 3000 pounds per pan. The alloy pans are perforated and are 72 inches long by 42 inches wide by 1/4 inch thick. Each pan weighs approximately 250 pounds. The loaded trays are pulled through the furnace on idler rollers by means of a chain and hook arrangement. At each end of the furnace are air locks which prevent air in-

filtration when charging or discharging the loaded trays.

After the work has been heated and held at the required temperature for the desired length of time, and before being discharged into the open atmosphere, it must first be cooled to a temperature at which it will not oxidize or tarnish when exposed to the open atmosphere. For this purpose, a special cooling chamber is incorporated in the furnace, from which the work is discharged at a temperature of approximately 150 degrees F. This cooling chamber is equipped with water-cooled panels and fans which draw the DX atmosphere through water-cooled radiators and then circulate it through the cooling chamber. The complete unit, including loading and unloading tables, requires a floor space 8 feet wide by 80 feet long.

* * *

High-Speed Milling of Shock-Absorber Parts

Shock-absorber parts of the type illustrated in Fig. 2 are rough- and finish-milled on surfaces *A* in a Sundstrand automatic hydraulic Rigidmil set up as shown in Fig. 1. These parts are iron castings, and are milled at the rate of 400 pieces an hour, based on an efficiency of 85 per cent. The machine head is equipped with four vertical cutter-spindles, each of which has an independent eccentric adjustment axially and a micrometer adjustment vertically. The hydraulically indexed fixture on the work-table is so positioned that two milling cutters are inside the fixture and two outside.

The fixture has eight stations, each of which holds two pieces of work. A counterweighted device enables the operator to locate the work-pieces correctly before clamping them. The table has an automatic cycle, including a hydraulic feed that can be varied from 1 to 50 inches a minute and a rapid traverse of 250 inches a minute.

In operation, the work is loaded in two empty stations at the front of the fixture and clamped. Then after a starting button has been pressed, the work is indexed automatically into the cutting position, and the table commences its automatic cycle of rapid approach to the right-hand cutters, feed, rapid approach to the left-hand cutters, feed, rapid return to the mid-position and stop. In the meantime, the operator has loaded two pieces of work in the next station of the fixture that has been indexed to the front of the machine.

After a lot of work-pieces has been run through the machine for the rough-milling operation, the same lot is run through a second time for finish-milling. The roughing cut is approximately 3/32 inch deep, and the finishing cut 0.015 inch deep. A fine finish is required, and both milled surfaces must be in the same plane within 0.002 inch. The pieces are 2 3/4 inches in diameter. Tungsten-carbide cutters are employed.

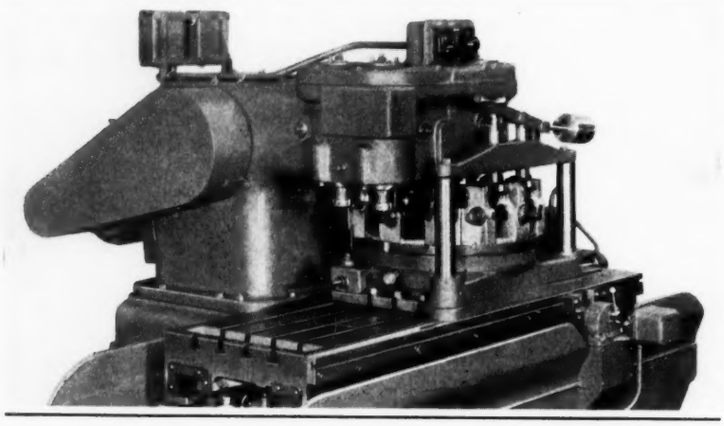


Fig. 1. Rigidmil Set up with Four Cutters and an Eight-station Fixture for Rough- and Finish-milling Shock-absorber Parts

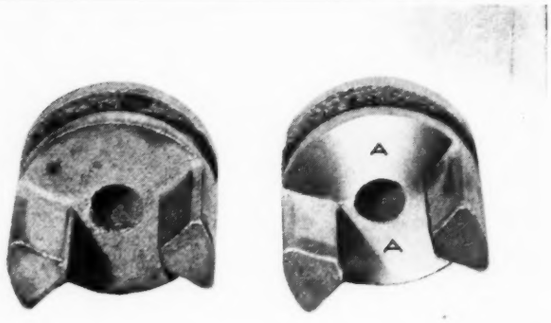


Fig. 2. Shock-absorber Abutment Flanges which are Finish-milled on Surfaces A at a High Production Rate

* * *

The habit of using alphabetical designations for scores of governmental departments, bureaus, projects, and for organizations of all kinds is rather confusing. Those who make regular use of these alphabetical designations may be perfectly familiar with their meaning, but the ordinary reader of technical magazines and newspapers is not familiar with the great number of combinations of letters now being used, and is often puzzled as to what commission or organization is being referred to. It is true that with the present multiplicity of governmental administrations and commissions, it is a considerable task to make use of their long and rather elaborate names, but it is better to use the complete name and be understood, than to use three or four capital letters that convey no meaning to the average reader of reports, technical papers, and magazine articles.

Paying Investments in New Equipment

Concrete Examples from Various Manufacturers Who Believe that Modernization Begins at Home—First of a Series of Articles from MACHINERY'S Modern Equipment Contest

THE mechanical industry teems with examples of savings directly traceable to the installation of improved tool equipment. In many instances, however, it is difficult and often impossible to determine the actual amount saved yearly. This is particularly true when the savings are only partially due to a higher rate of production. In the first example which follows, the principal saving was the direct result of a more accurate job. Unfortunately, the relation between an improvement in the quality of the work and the value of that improvement in dollars cannot, as a rule, be established readily, if at all. In this example, the savings due to improved quality of the work were determined only by a complete analysis. The example shows, however, that a thorough study of relative costs may reveal net savings that much more than justify the time required to make a careful analysis, as well as the cost of the latest and best equipment available.

Boring versus Grinding Locomotive Air-Pump Cylinders

The largest single item of operating expense on railroads is locomotive repairs. One item that proved to be well worth careful, thorough investigation was the cost of reconditioning locomotive air-pumps. The problem was to determine the cost of reconditioning cylinders by boring and by grinding, taking into account all of the important factors. The internal grinder used is especially adapted to this work, and is equipped with a swiveling type of pump fixture to facilitate adjustments and minimize the setting up time. The following cost data applies to 8 1/2-inch cross-compound pumps. The savings due to grinding the cylinders are the result of a reduction in (1) labor costs; (2) material costs; (3) maintenance costs; (4) steam consumption or operating costs. The latter is the most important item of all.

The unusual saving in labor is largely due to the fact that the cylinders remain assembled to the center casting for the internal grinding operation. By the boring method, the cylinders must be unbolted from the center casting, each cylinder or pair of cylinders set up and machined, then reassembled. These operations require about 10 hours of shop labor for an 8 1/2-inch cross-compound pump, and the alignment of the cylinders is seriously jeopardized on account of frequent warpage of the center castings and the inability of the assembler to draw the gaskets down evenly. For the grinding operation, the gaskets are not disturbed and all four cylinders of the assembled pump are ground in 4 hours or less, floor to floor. The accuracy of the swivel fixture on the grinder insures that the steam and air cylinders are ground in alignment, resulting in free action of the pistons, straight line travel of the piston-rods through the stuffing-boxes, and minimum, equally distributed wear in general.

Figures obtained from three different railroads show an average labor saving of $4.33 per ground pump. The number of times a cylinder bore can be reconditioned before reaching the 1/4-inch oversize limit depends upon the amount of metal removed each time and the wear. Cylinders that are bored normally are enlarged 1/16 inch, and this enlargement is required every 100,000 miles, or once in approximately every two years. With ground cylinders, the enlargement per reconditioning is only 1/32 inch, and this enlargement is required every 150,000 miles, or once every three years, approximately. Greater accuracy of alignment and superiority of finish in the ground cylinders also contribute to a reduction in wear. The increase in life of a cylinder reconditioned by grinding reduces the cost of new cylinder castings an amount equal to $7.27 per year per pump.

Reconditioning a ground cylinder every three years instead of every two, as required for bored cylinders, also results in an annual unit saving of $2.21 for enlarging piston-heads to fit the enlarged cylinders. The saving in connection with the piston-rings is another important item. When these maintenance costs are included with the labor and cylinder material costs, the average annual cost of a bored pump is about $48, whereas the average cost of a ground pump is nearly $22.

In determining the saving in steam consumption due to the superiority of the ground cylinders, three classes of tests were made. One was to determine the number of pump strokes required to fill an empty drum with 100 pounds pressure, the orifice being closed. The second test was to determine the efficiency of the ground pump compared with the bored pump by finding the number of strokes necessary to maintain maximum pressure.

The third test was to determine the maximum pressure that the pump would maintain in the drum with the orifice open. These tests indicated an annual saving of $111 per pump due to the higher efficiency of ground cylinders and the resulting reduction in steam consumption. This annual saving is based upon a conservative locomotive mileage of 50,000 service miles per year.

Paying for a New Machine with the Savings of a Month

The total annual saving per ground pump equals 26 + 111 = $137, including labor, materials, and steam. The machine used for this work is capable of grinding six hundred 8 1/2-inch cross-compound pumps per year; hence, in locomotive shops large enough to use the machine all the time for pump grinding, the yearly saving is over $82,000. The cost of the machine (f.o.b. factory) is $6180; hence the saving is over thirteen times this factory cost.

The grinder referred to, when provided with extra auxiliary equipment, can be applied to various other grinding operations connected with locomotive repairs, such as grinding rod bushings, valve motion parts, driving-boxes of the floating bushing type, etc. When applied to this miscellaneous work, yearly savings for repairs total about $274 per locomotive. In a small shop that overhauls three engines a month, or thirty-six a year, the annual savings of about $9860 exceed by approximately $450 the cost of a grinder fully equipped for this varied class of work.—H. H. MOOR, Sales Manager, Grinder Division, Micro-Westco, Inc., Bettendorf, Iowa

Investment in a New Milling Machine Earns 27 1/2 Per Cent

A milling machine twenty-seven years old was replaced by a new electrically controlled plain milling machine. Fig. 1 shows the old machine, and Fig. 2 the new one. The same piece of work is being milled in each case. These machines are used for short-run jobs similar to the one illustrated, there being about 1000 pieces in each lot. The savings shown by the following analysis are based on three different jobs, typical of what may be expected in regular small-lot production.

The increase in production for the three typical jobs referred to saves 38.8 per cent of the time. The average machine operating time is 2000 hours per year; therefore, the total saving in hours equals 2000 × 0.388 = 776 hours.

The average labor cost is $0.68 per hour, and the average burden rate (shop only) is $0.85 per hour. The allowable depreciation and interest on the machine is 10 per cent.

The cost of the new machine installed is $3280; the resale value of the old machine is $150, making the net cost of the new machine $3130.

Saving in labor per year based on 776 hours at $0.68	$527.68
Saving in burden per year based on 776 hours at $0.85	659.60
Total saving before depreciation	$1187.28

The annual depreciation and interest charge for the new machine at 10 per cent equals $325. There is no depreciation on the old machine. Deducting this annual depreciation, we have a net saving of $1187 — 325 = $862.

Fig. 1. Milling the Edges of Height Gage Jaws on an Old Machine at the Rate of 87 Pieces per Hour

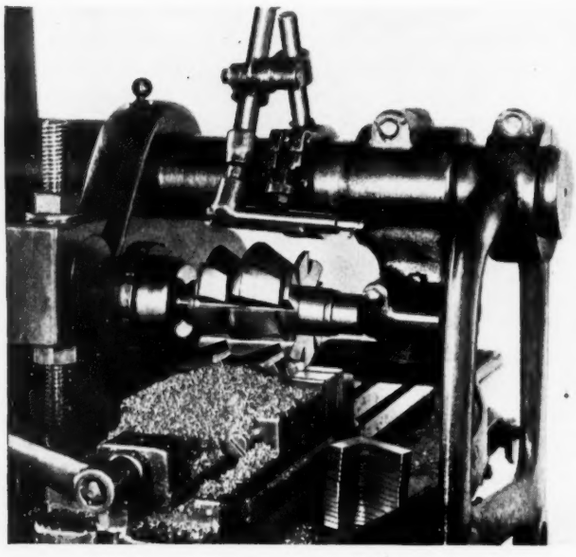
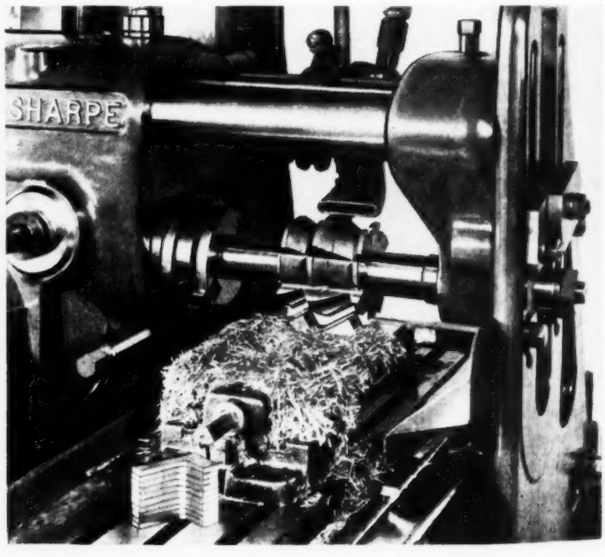


Fig. 2. By Using a Modern Machine the Production was Increased from 87 to 157 Pieces per Hour



Then the net annual return on the investment is:

$$\frac{\text{Total yearly saving}}{\text{Total investment}} = \frac{862}{3130} = 27.5\%$$

The time in which the equipment will pay for itself will be $\frac{3130}{862} = 3.6$ years.

There are several items not included in the foregoing saving because of the difficulties of obtaining accurate data. Cutter sharpening is less on the new machine, because it is much more rigid than the old one. A comparison of Figs. 1 and 2 will show that the chips from the old machine are smaller and more "chewed up," indicating greater vibration, and consequently greater cutter wear. The new machine is easier to set up and is more accurate, thus reducing spoilage.

As the new machine climbs or hook-mills, it rough-mills on the first cut, and then, on the table reversal, mills in the conventional manner, and so finish-mills. This produces a much better finish than the one operation of the old machine; the polishing time, consequently, is greatly reduced. The actual saving, however, is difficult to determine over a period of time, and, therefore, is not figured in the savings.

The same amount of floor space within 10 per cent is required for the old and new machines, and the same power consumption within 7 per cent. The tool equipment costs are also about the same, so that these items have not been included.—RICHMOND VIALL, Brown & Sharpe Mfg. Co., Providence, R. I.

[In the foregoing example, it will be noted that the overhead has been reduced to an hourly basis and the new machine is credited with the overhead per hour multiplied by the number of hours saved. The new machine is not idle during the time saved, but is utilized on the same or on similar classes of work.—EDITOR.]

Battery of Four Machines Earns About 15 Per Cent on the Investment

There seems to be a general impression that automatic machines are profitable only when applied to large quantities of some one product, or that a profitable machine must be a single-purpose type designed especially for producing a single part. The following and other examples, however, indicate that modern equipment often can be used to great advantage even on small runs and on machining diversified parts.

The illustration Fig. 3 shows four "automatics" used for machining large bevel- and spur-gear blanks and many other parts employed in printing presses. This work was done formerly on boring mills, turret lathes, and engine lathes.

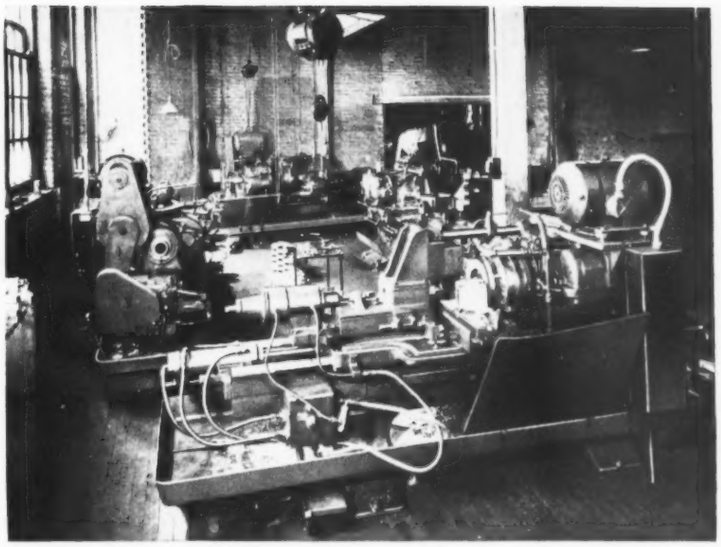


Fig. 3. This Battery of Four Automatics Used for Machining Gear Blanks Earns About 15 Per Cent on the Investment

One operator runs the battery of four machines, and changes from one job to another are almost invariably made while two or three of the machines are in operation, so that the setting-up cost is very low. The machines previously used employed four operators, so that three men are released for other work in the same plant. The battery of four machines operate sixteen hours per day and about 300 days per year during normal times.

The release of three operators for other work resulted in an hourly labor saving of $0.80 \times 3 =$ \$2.40. The total saving for a sixteen-hour day $= 2.40 \times 16 =$ \$38.40. The total saving for a 300-day year (before deducting depreciation) $= 38.40 \times 300 =$ \$11,520.

The investment in the equipment is \$45,000 and at 10 per cent, the annual depreciation charge equals \$4500. The total saving, less depreciation, equals $11520 - 4500 =$ \$7020.

The total amount earned on the investment equals $\frac{7020}{45000} = 15.6$ per cent. This is an attractive return on the investment, especially in view of the fact that fully automatic machines in this case are used in producing a line of diversified parts in small-lot runs.—I. F. YEOMAN, Elkhart, Ind.

[If the average annual interest had been deducted from the annual savings, the net return would equal about 12 per cent. Assuming that the interest rate is 6 per cent, then the average interest in this case, taking into account annual depreciation based upon an estimated life of ten years, equals $\frac{11}{10} \times 45000 \times \frac{0.06}{2} = 1485$; hence net return on investment would equal $\frac{7020 - 1485}{45000} = 12.3$ per cent.—EDITOR.]

Rear-Axle Housings Finished

THE rear-axle housings for automobiles manufactured by the Packard Motor Car Co., are largely finished by the Baush machine here illustrated. This machine is equipped with a seven-station hand-indexed trunnion which carries each housing successively to boring, drilling, reaming, facing, and turning tools. Most of the tools are mounted in spindles carried by two heads which are hydraulically operated on the ways of the bed. There is, however, a third head at the rear of the machine, electrically actuated, which drills nine holes in the banjo flange.

Each station of the trunnion is provided with V-blocks and clamps for seating and locking the ends of the rear-axle housings. At the center of each station there is a fixture for supporting and clamping the banjo, the clamp being applied to the finished banjo face.

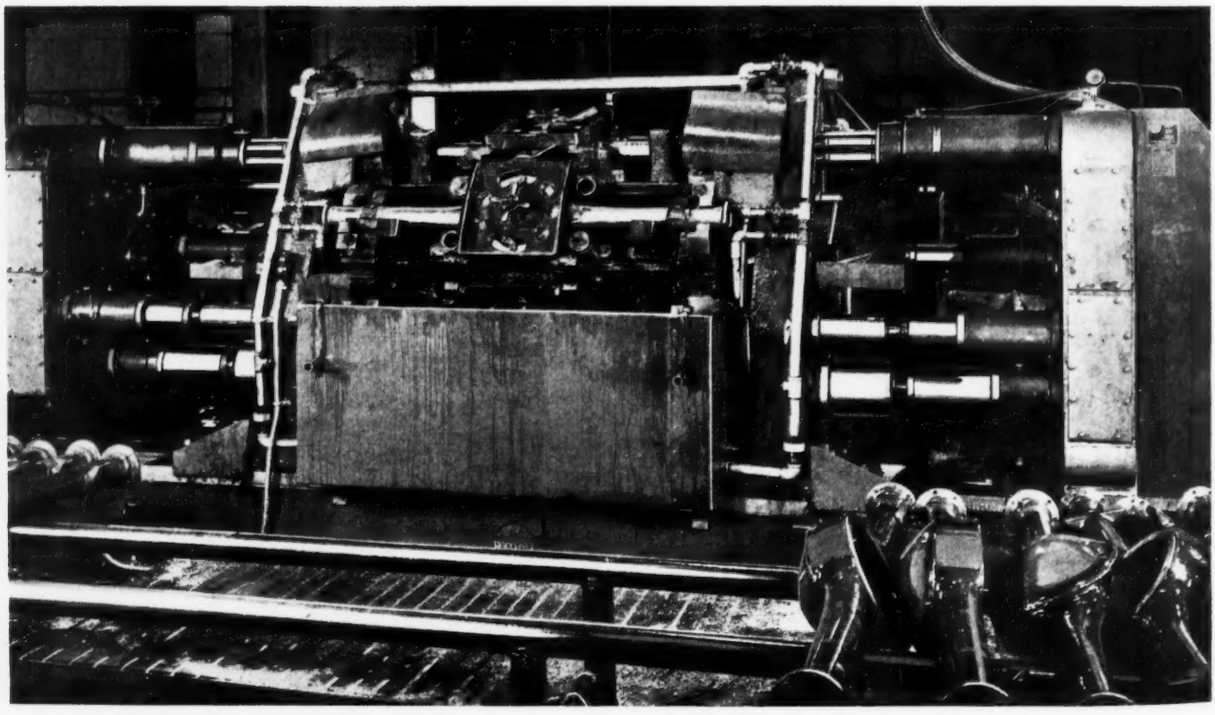
From the first or loading station, each rear-axle housing is indexed downward to the second station, where both ends are simultaneously rough-counterbored to two diameters and to specified depths by double counterbores of the design seen at *W*, Fig. 2. The larger counterbored hole is also chamfered by the same tool. These tools have long pilots that are fitted with bronze contacting strips, which may be conveniently replaced when worn.

At the third station, the same two surfaces are semi-finish-reamed by the double inserted-blade cutter illustrated at *X*, Fig. 2. Mounted on the same holder as this cutter are three single-point tools for taking rough- and finish-turning cuts and a chamfering cut on the flange at both ends of the rear-axle housing.

At the fourth station, each flanged end of the housing is faced both on the front and back sides by tools that are revolved around the flanges. These tools are mounted on heads designed as illustrated at *Y*, Fig. 2. Three cutter bits are mounted on a sliding block that is fed radially to carry the cutters across the surfaces to be machined. The finishing of the outer flange face is divided between two cutters, one of which operates from the bore toward the periphery of the flange and the other from the periphery toward the bore.

The diagram shows the tool with the various moving parts in the positions they occupy when the cuts are completed. At the beginning of an operation, the outer cutter bits are withdrawn radi-

Fig. 1. Seven-station Hydraulically Actuated Machine which Performs a Large Number of Boring, Drilling, Reaming, Facing, and Turning Operations on Packard Rear-axle Housings



in a Seven-Station Machine

ally from the position shown, so as to clear the flange. Pin *A*, attached to bar *B*, is in contact with the opposite end of cam slot *C*, which is machined in the block on which tool-slide *D* is mounted. When the head of the machine is fed forward, tool-slide *D* also advances until the ball-bearing stop-nut *E* comes in contact with the face of the large pilot bushing in which the tool revolves. Then the body of the tool is prevented from advancing farther, but the inner bar *B* continues, with the result that cam slot *C* causes pin *A* and slide *D* to be moved sidewise an amount equal to the incline of the cam slot. Upon the reversal of the machine head, spring *F* expands and prevents slide *D* from moving lengthwise with the tool until after it has been withdrawn radially to clear the work.

The fifth operation consists of finish-facing the outer face of each flange and finishing the large counterbore to receive an anti-friction bearing. These cuts are taken by tools designed as illustrated at *Z*, Fig. 2. The counterboring tool is adjustable in its holder for depth of the counterbore face. The revolving pilot is fitted with renewable wear strips.

At the same time that these cuts are being taken, the nine holes are being drilled in the banjo face by the head at the rear of the machine.

Reamers of the disk type, described in September, 1936, MACHINERY, pages 30 to 33, are employed at the sixth station to finish the bearing seats in the ends of the housing to the specified diameter. Previous to the adoption of reamers of this type, a great deal of difficulty was experienced in taking these cuts. Seven holes are drilled in each flange at the ends of the housing when it reaches the seventh station, and at the same time, combination tools take several reaming cuts in the housing ends. All the tools used in these operations, except the disk reamers, were made by the Gairing Tool Co.

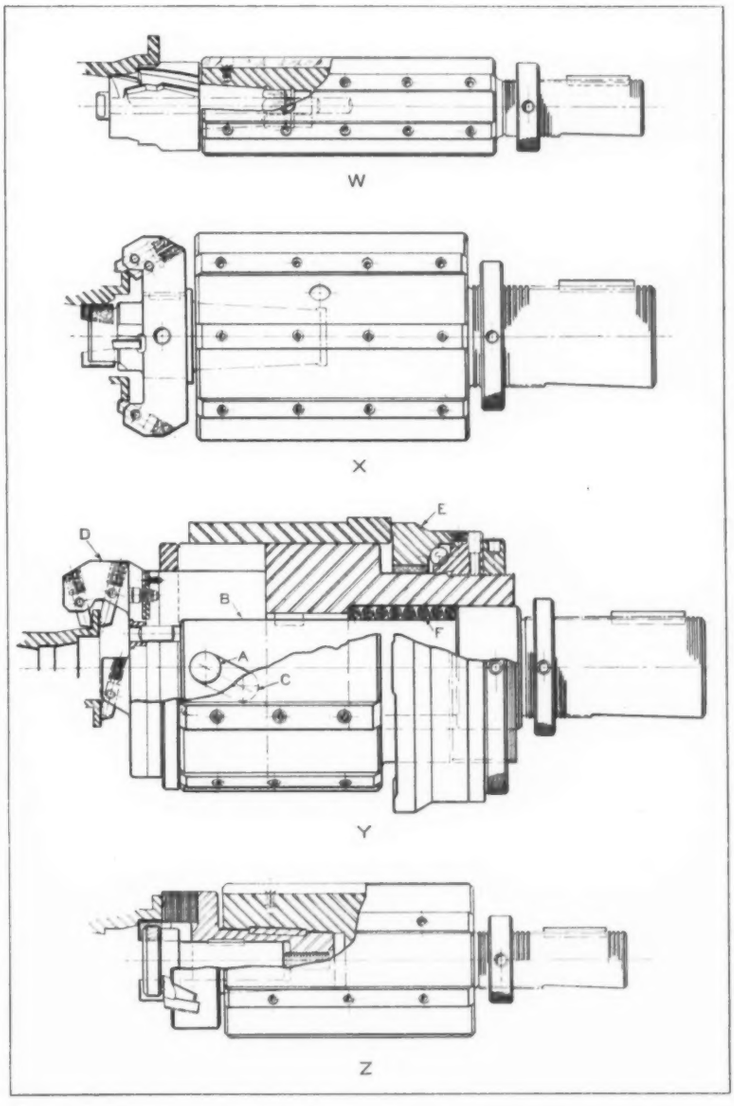


Fig. 2. Special Tools Used in Boring, Facing and Turning Packard Rear-axle Housings

* * *

In 1900, an authority declared that the incandescent lamp was almost perfect. It is now five times as efficient. Lamps of 1900, if used in 1937, would raise America's light bill $5,000,000 each night.—*Factory Management and Maintenance*

Color Code for Marking Steel Bars

A Simplified Practice Recommendation for a color code for marking steel bars has received the required degree of acceptance by industry and will be published by the Division of Simplified Practice, National Bureau of Standards, Washington, D. C. It is identified as Simplified Practice Recommendation R166-37. The recommendation, which was proposed and developed by the National Committee on Iron and Steel of the National Association of Purchasing Agents, is limited to a color code for marking the commonly used grades of steel as represented by S A E numbers.

Engineering News Flashes

The World Over

Diamond Tool Bores More Than 200,000 Wrist-Pin Holes

Recently, in a Detroit automobile plant, a diamond tool provided with a diamond weighing less than one-half carat took a finishing cut on the wrist-pin holes of over 200,000 aluminum-alloy pistons before the diamond had to be resharpened. A Koebel diamond tool was used in an Ex-Cell-O boring machine. The total length of the "hole" bored was approximately twelve miles. Of course, after having performed this service, the diamond was not worn out; it required only relapping to the correct radius to prepare it for a similar period of productive life.

Motor Trucks with Movable Floors

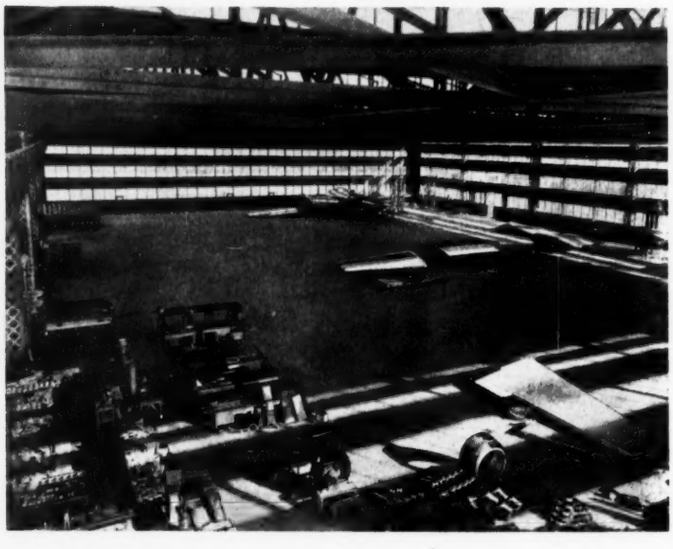
A unique development in truck body design, consisting of a movable floor which simplifies loading and unloading, has been introduced by the Easton Car & Construction Co., Easton, Pa. This movable truck floor is known by the trade name "Loryflor." It consists of a single sheet of highly durable cord rubber belting, supported beneath by tiers of steel rollers. The belting is long enough to be rolled or moved one complete floor length to either end of the truck. The floor is operated by means of a crank-handle. It is obvious that any load on the floor will be moved either on or off the truck as the floor moves along. It requires very little effort on the part of one man to move a considerable load into the truck or out onto a platform against which the truck may be backed up. Of course, the load can also be dumped on the ground from the moving floor with equal facility.

Roller Bearings Weighing Over Ten Tons Each

Eight roller bearings made by the Bantam Bearings Corporation, South Bend, Ind., each weighing 22,500 pounds, are used in the Torrence Ave. Bridge in Chicago, just being completed. The bridge rests on these bearings when a bridge span 276 feet long, weighing about 1600 tons, is lifted to permit river traffic to pass.

British Claim New Steam Train Record

While remarkable performances have been recorded with Diesel engine railroad trains in this country, the British have been busy determining the feasibility of higher speeds with steam locomotives. Recently two runs, of 803 miles each, were made from London to Glasgow and return at an average speed of sixty-nine miles per hour with steam trains consisting of seven and eight cars behind the engine. In these tests, 401 con-



General View of New Boeing Aircraft Assembly Plant at Seattle, Wash. The New Structure Has One of the Largest Unobstructed Inside Working Areas (if Not the Largest) ever Provided in an Industrial Plant. The Building is 204 by 304 Feet, with a Clear Height of 35 Feet, and there are No Pillars or Obstructions of Any Kind

secutive miles on a non-stop run were covered at an average speed of seventy miles an hour. Since the object of these runs was to establish the feasibility of high average speeds, rather than of high maximum speeds, the schedule incorporated a restriction of the speed at any time to ninety miles per hour, although on one or two short stretches this speed was slightly exceeded.

Boilers as Tall as a Ten-Story Building

In their search for higher economy in the generation of power in large quantities, engineers have resorted to constantly larger and larger boilers, until today there are operated in this country six units capable of producing a million pounds of steam per hour or more each. All of these are in operation in the New York metropolitan district. These great steam generating units are as tall as a ten-story building. When operating at full capacity, one such boiler can furnish steam sufficient to meet the electric current requirements of a city of about 500,000 people.

Color Finish of Chromium Aided by New Primer

Chromium is notably difficult to lacquer or enamel. In fact, air-drying lacquers will not adhere to it satisfactorily. However, by the use of a new primer, recently developed by Maas & Waldstein Co., Newark, N. J., chromium can be finished to any desired color. The new product is known as "Chroprime," which can be applied to the metal surface by spraying or dipping, after which it is baked. It adheres tenaciously to the metal and provides a foundation for any kind of lacquer enamel. It resists heat and remains flexible, and permits the metal to be engraved after it is applied. It is finding extensive application at present in the making of automobile name-plates and for other purposes where colors are wanted on a corrosion-proof base. The primer can also be used as a durable under-coat for finishing other metals.

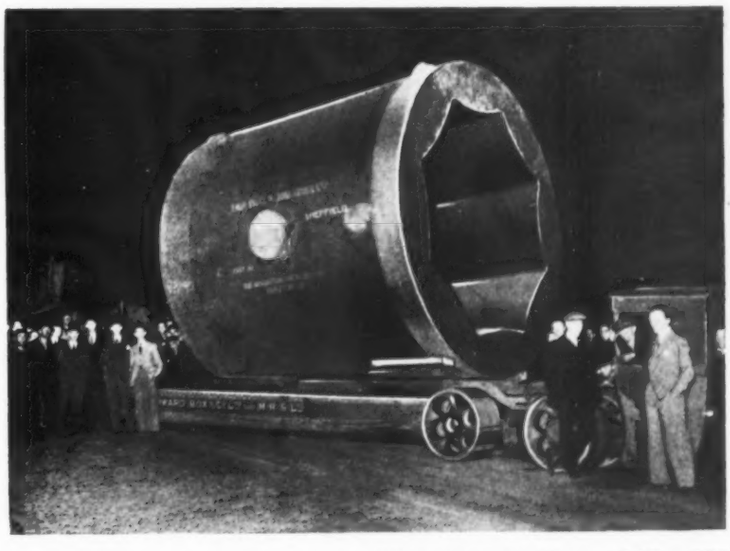
Three-Dimensional Industrial Movies

A most unusual type of motion pictures—three-dimensional movies in full color—was recently demonstrated at the New York Museum of Science and Industry at Rockefeller Center, New York City. These pictures showed the various operations in making valves. The films were taken in the factory of the Hancock Valve Division of the Consolidated Ashcroft Hancock Co., Bridgeport, Conn. In this type of motion picture, one does not perceive the usual screen. Rather, the effect is that of looking through a window, inside of which real people and objects are walking about at different distances from the observer.

These three-dimensional colored movies make the foundry pictured seem almost real. The molten metal has natural colors and "thickness"; machines, molds, and other objects look as if they could be actually handled; sparks appear to fly right out of the screen. The "Polaroid" system that is used is said to be the first practical means of showing depth movies in full color. Such pictures are made possible by "Polaroid," a new kind of glass that modifies or polarizes the light that passes through it.

Magnesium Production in Great Britain

Magnesium, the latest metal to be brought into commercial use, is now, according to *Industrial Britain*, being produced in Great Britain by the firm of Magnesium Elektron, Ltd., at Clifton Junction, near Manchester. The British-made product, consisting of a group of magnesium alloys 40 per cent lighter than aluminum, is sold under the trade name "Elektron."



What is Believed to be the World's Largest Ingot Mold was Recently Produced by the Brightside Foundry & Engineering Co. of Sheffield, England. It Weighs Over 150 Tons, and is 13 1/2 Feet Long and Approximately 12 Feet in Diameter. Ingots Weighing More than 200 Tons will be Cast in this Mold

EDITORIAL COMMENT

Buying Lubricating Oil on Price Rather than on Quality

Much has been said about the tendency to buy on the basis of price rather than quality. In many instances, it is easy to determine when the quality of one product is better than that of another. In other cases, it may be difficult for the ordinary purchaser to determine quality definitely; but he can generally be assured, in the mechanical field at least, that an industrial product commanding a higher price is also of higher quality.

These remarks are especially applicable to lubricating oils. Such oils constitute an item that should never be bought on price. High-grade lubrication saves expense in the maintenance and repairs of machine equipment. It is generally realized that it is false economy to buy inferior machines and tools; it should also be recognized that it is equally false economy to buy high-grade machines and permit them to deteriorate or age prematurely by using lubricating oil of inferior quality.

Dolls' Voices and Coconut Graters All in the Day's Work

One of the important services rendered by a technical publication is that of bringing together the manufacturer who has something to sell and the user who has need for some specific machine or device. Many inquiries as to who makes equipment of this or that type are answered daily by the editors. Obviously, most of these relate to mechanical equipment, but many pertain to a great variety of machines and products in all kinds of industries where sources of supplies are difficult to locate.

A few days ago, a machinery dealer wanted to find out where he could buy an automatic machine for extracting the pits from dates; another wanted machines for grating coconuts; and still another firm wanted to know where to buy "dolls' voices." It was possible to answer even these very special inquiries, because an engineering publication, like MACHINERY, by necessity must have an index of tens of thousands of manufacturers of every conceivable product.

Every mail brings inquiries of this character from concerns all over the world. The furnishing of such information is a service that technical publications render without charge, in order to promote business in the industries that they serve.

Misinformation on Industry in Newspapers

Frequently one sees in the daily newspapers and popular magazines articles on industrial conditions written by men who, while they claim to write authoritatively, obviously have only a very slight acquaintance with the subjects about which they are trying to inform other people. It is unfortunate that the editors and publishers do not take more pains than they do to ascertain to what extent the information is accurate.

Some time ago there appeared in a leading New England newspaper an article on the conditions in the plants of the automotive industry that, for misinformation, inaccuracy, and downright untruthfulness about the safe working conditions in these plants, surpassed anything that we have ever read. Anyone having the most superficial knowledge of the automotive industry would know that the statements in the article had no foundation in fact. But there are millions of well meaning people who know little or nothing about industry, and who through such false representations become prejudiced against one of the best managed industries in the country.

Unfortunately, there is no way to combat such practices of spreading untruthful information except to depend upon the integrity and vigilance of the newspaper and magazine editor. If he lends his publication to purposes of vilification of the good name of reputable industries without mentioning specific names, he cannot be sued for libel. As a result, the industry as a whole is attacked and the industry as a whole suffers. The authors of these articles frequently write under assumed names or hide anonymously behind the editor.

In the case mentioned, it should be said to the credit of the editor that when his attention was called to the unfairness of the article, he sent a reporter to Detroit to investigate matters first-hand, and published another article to correct the false impressions created by the first.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Lever-Operated Mechanism for Advancing Gear-Driven Shaft

By L. KASPER

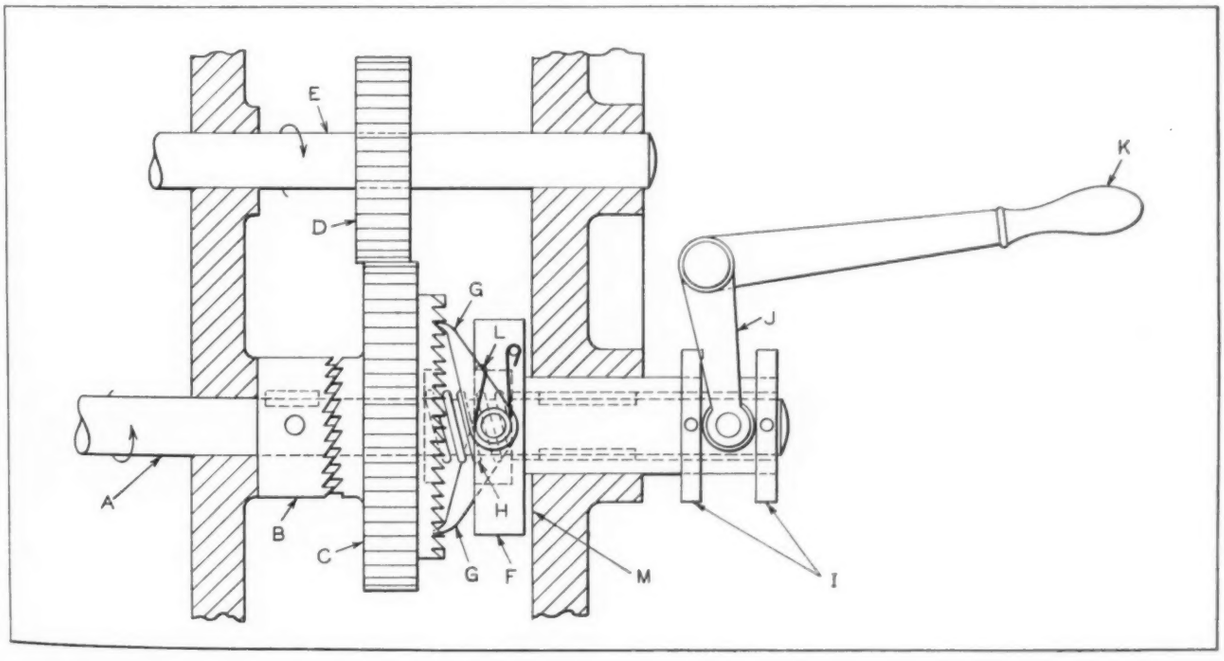
In operating a wire-forming machine, it is necessary to maintain a certain amount of slack in the wire as it passes through the machine. At times, the slack is taken up by uncontrollable conditions and must be increased while the machine is in operation. The accompanying illustration shows the construction of a mechanism by means of which the amount of slack is manually controlled.

The shaft *A*, rotating in the direction indicated by the arrow, normally drives shaft *E* through the gears *C* and *D*, the ratchet teeth cut on the side of the collar *B*, which is keyed to shaft *A*, being engaged with similar teeth cut on the hub of gear *C*. Spring *H* serves to maintain contact between the ratchet teeth, so that gear *C* is positively driven. The illustration, however, shows the ratchet teeth partly disengaged.

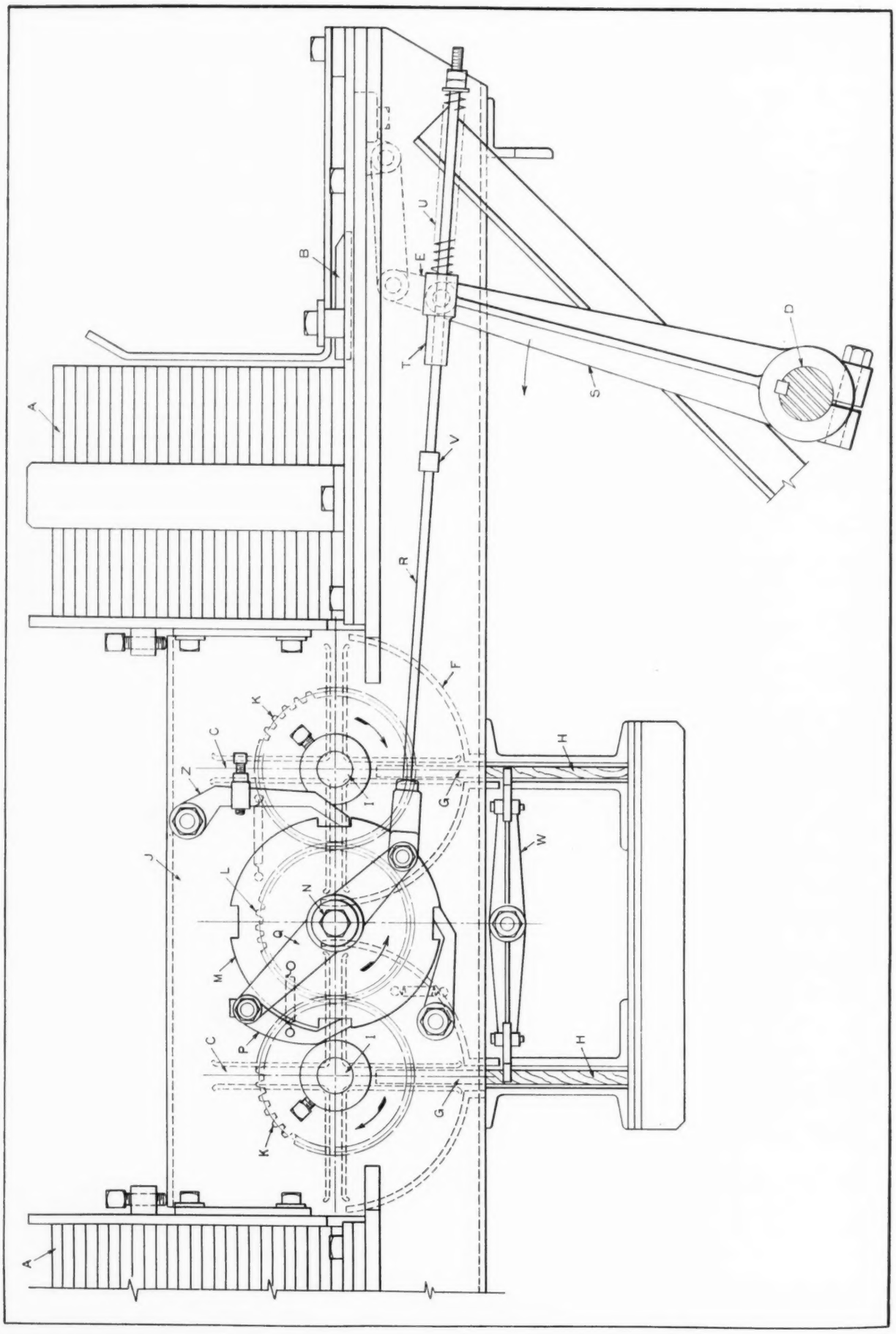
The sleeve *F* is splined to shaft *A* and rotates with it, but is capable of axial movement, being moved to the left, as shown, when pressure is applied to the left-hand collar *I* by the handle *K* through the fork-shaped lever *J*. The spring *H* normally holds sleeve *F* in contact with the frame at *M*. Two pawls *G* are carried on sleeve *F* and are held in contact with the ratchet teeth on the right-hand side of gear *C* by springs *L*.

As sleeve *F* is splined to shaft *A*, it normally rotates with it, the ratchet teeth in collar *B* and gear *C* being engaged and the pawls *G* merely resting on the ratchet teeth on gear *C*. In this position, the pawls *G* do not in any way aid in transmitting motion to gear *C*. Thus the entire assembly on shaft *A* rotates as a unit, the effect being the same as with a plain gear drive.

When it is necessary to increase the slack in the wire, the handle *K* is depressed, causing lever *J* to move sleeve *F* to the left, as shown, and the pawls *G* to spread or flatten out similar to toggle levers. As these pawls spread, they exert a turning effect on gear *C*, advancing it relative to collar *B* and causing the ratchet teeth on the hub of gear *C* to ride over those on collar *B*. When gear *C* has been thus advanced a distance equal to one tooth space, spring *H* causes it to slide to the left and re-engage the teeth on collar *B*.



Mechanism which Permits Driven Shaft E to be Advanced Ahead of Driving Shaft A by Means of Hand-lever K



Mechanism that Feeds Two Boards Simultaneously from Hoppers A to Chutes H

Feeding Mechanism for Box-Nailing Machine

By J. J. PESQUEIRA

The purpose of the device shown in the accompanying illustration is to feed wooden boards, two at a time, in a vertical position into a box nailing machine. The main feature of this feeding mechanism is its positive action in turning the boards from the flat position, in which they are stacked in the hoppers, to the upright position, in which they must be fed to the nailing machine.

The boards, which are 7 inches wide by 9 inches long and from 3/8 to 1/2 inch thick, are fed simultaneously in pairs at the rate of thirty-six pairs a minute. They are first stacked up by hand in the two opposite hoppers *A*, the two lowest boards being simultaneously carried into intermittently revolving cross-shaped members *C* by means of lateral feeding mechanisms or "kickers" *B*. These kickers are operated by the oscillating shaft *D* through levers *E*.

Members *C*, each of which is built up of four L-shaped plates so arranged as to form two passages at right angles to each other, revolve in troughs *F*, which have apertures *G* at the bottom for discharging the boards into the chutes *H*. End pivot shafts *I* of members *C* are journaled in an end plate *J*, and the opposite pivot shafts are journaled in a similar end plate at the opposite end of troughs *F*. Spur gears *K* are mounted on shafts *I* and mesh with the central spur gear *L*, the latter being attached to the four-notched wheel *M*, which freely rotates on pivot stud *N*. With this gearing, by turning wheel *M*, members *C* are made to rotate simultaneously.

Wheel *M* is operated as an ordinary ratchet wheel by pawl *P*, pivoted at the upper end of rocker *Q*, which, in turn, oscillates on pivot *N* under the action of the connecting-rod *R* attached to the lower end of rocker *Q*. The rod *R* is attached to the end of lever *S*, which is mounted also on the oscillating shaft *D*, by means of block *T*, through which the connecting-rod is free to slide. A precharged spring *U* constrains the motion of the connecting-rod in one direction, while a stop *V*, rigidly attached to the connecting-rod, constrains the motion in the other direction.

As levers *E* and *S* move together in the direction shown by the arrow, the lowest wooden boards in the hoppers are introduced into the momentarily stationary members *C*, while block *T* approaches stop *V*, finally reaching it and carrying it forward, together with the connecting-rod. This causes rocker *Q* to bring pawl *P* to the point where it will engage the upper notch of wheel *M*, and at the same time lifts stationary pawl *Z*, thus setting *M* free to rotate in the direction of the arrow.

As levers *E* and *S* return together to the starting position, kickers *B* will withdraw from under the stacks of boards, letting them drop under their own weight to the bottom of the hoppers. During this interval, lever *S*, pressing against spring *U*, will pull the connecting-rod to the right, causing wheel *M* to rotate until pawl *Z* drops into the next notch, thus preventing wheel *M* from advancing beyond one-quarter of a revolution.

As wheel *M* stops, lever *S* will continue to compress spring *U* until the end of the return stroke. Thus, there is a dwelling period between the completion of the quarter of a revolution of wheel *M* and the end of the return stroke of arm *S*, intended to give the wooden boards ample time to drop under their own weight to the bottom of chutes *H*, through which they are carried to the nailing machine table by the cross-head *W*, which moves in synchronism with the kickers *B*.

* * *

Correct Declarations for Export Shipments Insure Accurate Statistics

The exports of machine tools in 1936 aggregated $24,800,000, according to data compiled by the Bureau of Foreign and Domestic Commerce. This is the highest annual value of machine tool exports during the last ten years. The importance that these exports are now assuming emphasizes the need for accurate statistics to keep the industry informed on current export activities. In order that the breakdown of the export figures into machine groups may be of real value, the accuracy of the classifications is of great importance.

According to the National Machine Tool Builders' Association, there have been some obvious errors in the allocation of exports to the various classes. Investigation has shown that such errors are due in large part to inaccurate or incomplete description of goods on the "Shipper's Declaration," and particularly to the insertion of wrong class numbers in the last column of the declaration.

The Department of Commerce at Washington is anxious to cooperate with the machinery industries to the fullest extent in order to improve the accuracy of export statistics, and for this purpose, has published a booklet entitled "Shippers' Guide in Declaring Machinery for Export," which gives instructions for the correct preparation of export declarations. It is important that the matter of classification should not be left to a clerk who is unfamiliar with the character of the equipment being shipped. The export declaration should be filled out by someone thoroughly familiar with the classes of machinery being exported.

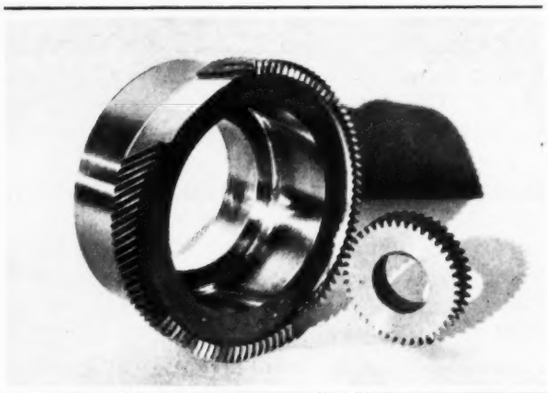
* * *

The gasoline consumption by motor vehicles in the United States in 1936—retail value including taxes—amounted to $3,300,000,000. There were also 535,000,000 gallons of lubricants used by motor vehicles, an equivalent of 57 per cent of all lubricants produced.

A New Method for Cutting Small Gears

Fellows Gap Type Gear Shaper Cutters Rough- and Finish-Cut Gears up to 2 1/2-Inch Pitch Diameter in One Operation to High-Precision Limits at Low Cost

By DOUGLAS T. HAMILTON
Fellows Gear Shaper Co., Springfield, Vt.



THE customary practice in cutting small gears, particularly those of 16 diametral pitch and finer, is to rough and finish the gear in two cuts, using the same cutter teeth for both operations. Most of the material is removed in the roughing operation, which, obviously, dulls the teeth more than the finishing cut, thus requiring, for best results, more frequent resharpening of the cutter. Also, the roughing operation cannot be accomplished as rapidly as if the same cutter were not used for finishing, because the roughing operation has to be slowed down to the point where the teeth will not dull too rapidly, in order to keep them in the best possible condition for the finishing cut.

A gear-tooth profile, as cut by the method just described, is illustrated diagrammatically at *A* in Fig. 1, which indicates that when the same cutter teeth are used for roughing and finishing, considerable stock must be left on the sides of the gear teeth for finishing; also, more material remains at the roots of the teeth. In the finishing cut, the cutter must remove stock both from the sides and roots of the teeth, and therefore has more work to do than if the gear teeth were roughed to full depth, requiring only a light cut on the sides of the teeth for finishing.

When a Fellows "gap type" cutter is used, most of the stock is removed by the roughing row of teeth on the cutter blank, and the finishing is done by a separate row of teeth. With this method, the teeth on the gear are cut to full depth in the roughing operation, and the finishing teeth on the cutter are only called upon to take a light cut from the sides of the teeth. As the finishing teeth have less work to do than in the previous case, they do not dull as rapidly. On 40-pitch gears and finer, from 0.001 to 0.002 inch of material on the sides of the teeth is usually sufficient allowance for the finish cut, as shown diagrammatically at *B*, Fig. 1. The result is greater accuracy, longer cutter life, and higher production.

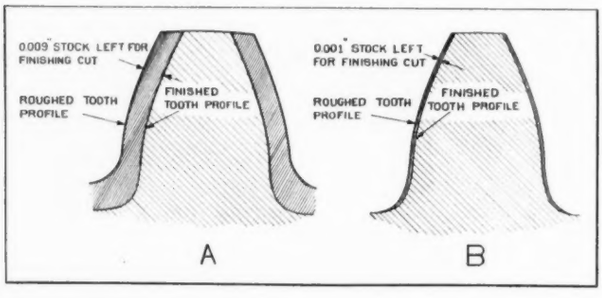


Fig. 1. Comparison of Gear Teeth Roughed and Finished with Regular and Gap Type Cutters

Another advantage of the gap type cutter, particularly from the standpoint of accuracy, is illustrated diagrammatically in Fig. 2. For the sake of simplicity, the gear blank is indicated as having a planetary motion around the cutter, whereas in actual operation, the cutter and the work rotate in synchronism.

Each tooth on the cutter always finishes the same mating tooth space in the work. In other words, there is no overlapping of the cutter teeth; hence, spacing and other errors in the cutter are not multiplied on the work. Eccentricity is also reduced to a minimum, as the cutter makes only part of a revolution—depending on the number of gaps and rows of teeth—in finishing the gear. Still another advantage is that during the entire cutting operation—roughing and finishing—the position of the saddle on the machine is unchanged, thus assuring more positive control of the size.

Gap Type Cutter Made in a Variety of Forms

The gap type cutter can be made with several arrangements of the cutting teeth. As shown in Fig. 2, it can be made with one row of roughing and one row of finishing teeth. The teeth can also be made to rough to full depth in the roughing operation or not, as desired. The thickness of the

cutter teeth can be made to leave different amounts of material on the sides of the gear teeth for the finishing cut, depending upon the pitch. As a rule, the finer the pitch, the less the amount of material left on the sides of the teeth for finishing.

The cutter shown in Fig. 3 is designed to take one roughing and one finishing cut, and is provided with two gaps, so that two gears are produced at each complete revolution of the cutter. In some cases, it is advantageous to divide the cutting between three sets of teeth. This practice is desirable when exceptionally close limits must be maintained, or when fine-pitch gears are to be cut, especially if made from soft materials, such as brass. Such a gap cutter is shown in Fig. 4. The pinion to be cut has ten teeth, and the cutter a total of sixty teeth. The cutter is made with two gaps, two stages of roughing, and one set of finishing teeth for each lobe. The roughing and finishing teeth are made to the same length in this case, but vary in thickness, the finishing teeth being only a few thousandths of an inch thicker than the second stage of roughing teeth. The reason for this arrangement is to leave as little stock as possible on the sides of the pinion teeth for the finishing cut, and hence reduce deflection to a minimum.

In Figs. 3 and 4, the cutters are shown with the cutting faces up. When used on the gear shaper, they are held with the cutting faces down, cutting on the "push" stroke. When the cutters are located on the spindle with the cutting faces down and rotated in a clockwise direction relative to the work (shown in full outline), the roughing teeth come in contact with the work first.

In order to adapt the Fellows high-speed gear shaper to the use of gap type cutters, arrangements must be provided for stopping the machine so that the gap in the cutter will always stop in a definite position with relation to the work. This is provided for electrically by equipping the machine with a cam-operated limit switch and timing change-gears.

Examples of Gap Cutter Economy

Gears for motion picture cameras and projectors are one of the many classes of work which can be more accurately cut and produced at lower cost by gap type cutters, as the examples shown in the following pages indicate. Methods now in actual operation are illustrated and described.

Fig. 2. Each Tooth on the Cutter Always Finishes the Same Mating Tooth Space in the Work

Fig. 3. Cutter with Two Gaps and Two Sets of Roughing and Finishing Teeth. Pinion is Rough- and Finish-cut in One-half Revolution of the Cutter

Fig. 4. Cutter with Two Gaps Arranged to Take Two Roughing and One Finishing Cut, One-half Revolution of the Cutter Completing the Work

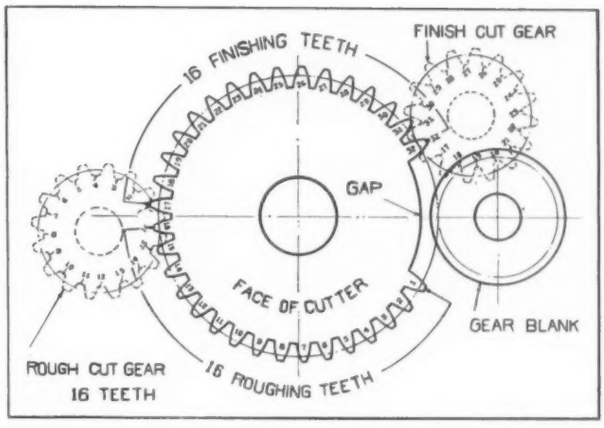


Fig. 2

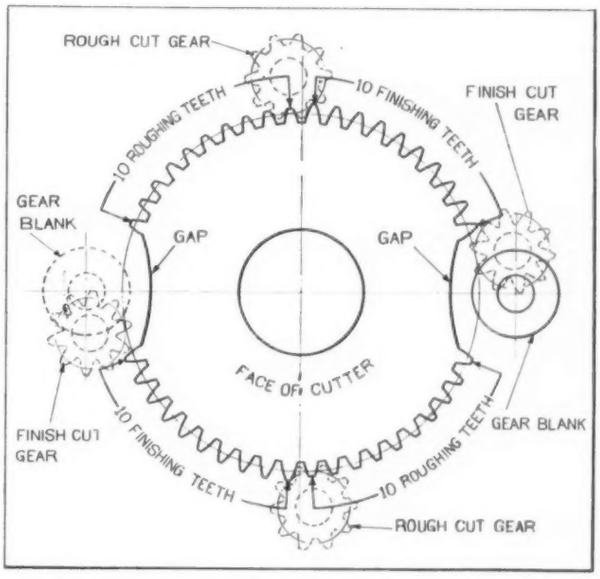


Fig. 3

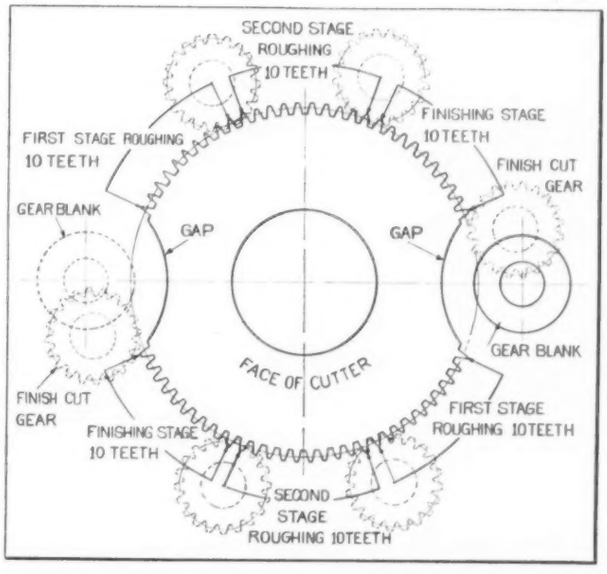
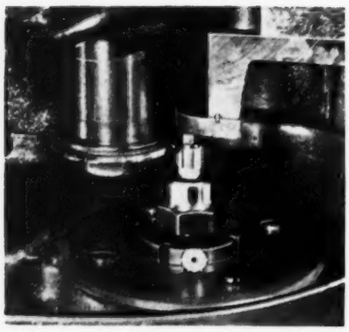
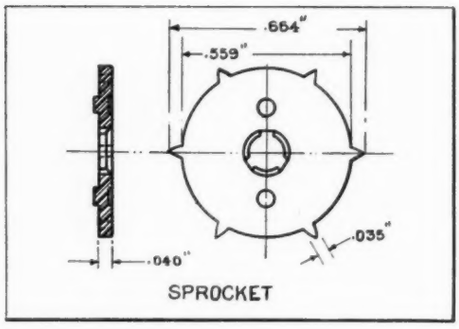


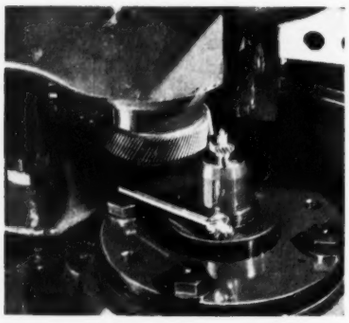
Fig. 4



Cutting Six-Tooth Sprocket

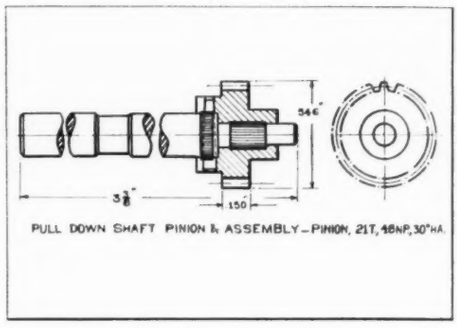
Fig. 5 shows set-up for cutting a six-tooth sprocket. This comes to the gear shaper from the punch press after it has been blanked to size and the hole perforated. Twelve of these blanks are held on the arbor at one time. With the gap type cutter, over six times as many pieces were produced per grind of the cutter as with the regular cutter. The new type cutter also produced twice as many pieces per hour and with greater precision.

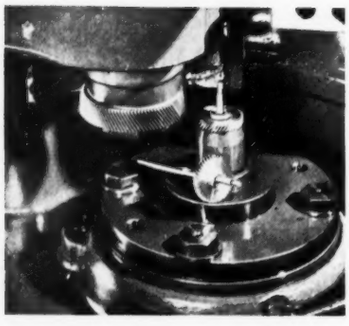




Shutter Pinion

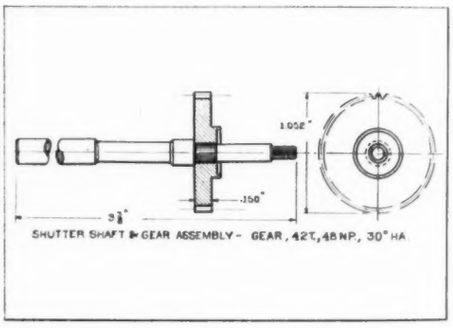
Fig. 6 shows set-up for cutting a shutter pinion made from steel. Prior to cutting, this pinion is staked on the shaft and then cut one at a time. The gap cutter nearly doubled production, and the quality was greatly improved. There was also a decided reduction in parts rejected in inspection. The new cutter lasted five times as long per grind as the old. The work was clean and free from burrs, which eliminated a burring operation.

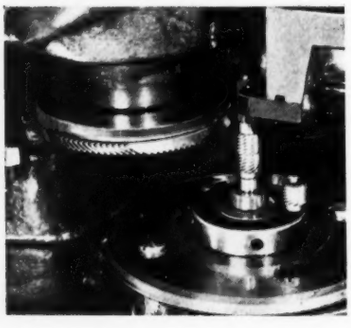




Shutter Gear

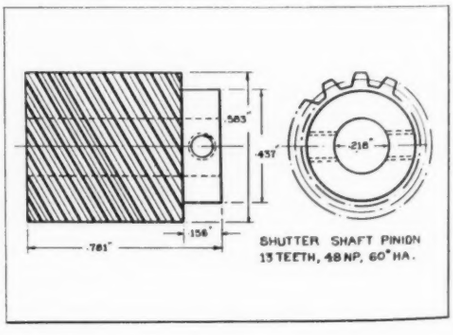
Fig. 7 shows set-up for cutting a shutter gear made from brass. This gear also is staked to the shaft before cutting, making it necessary to cut only one at a time. The new type gap cutter more than doubled production on this particular part, and produced ten times as many pieces per grind as the regular cutter. This part also had extremely close tolerances, and the new type gap cutter effected a decided reduction in rejected parts.

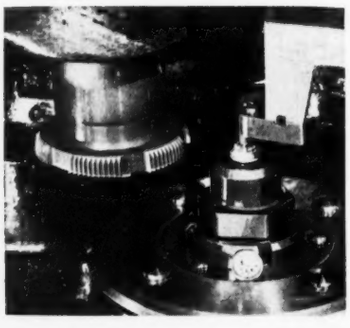




Helical Shutter Pinion

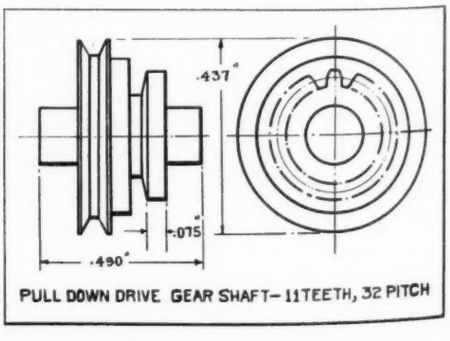
Fig. 8 shows set-up for cutting two steel helical shutter pinions at one setting. The same advantages were obtained on this job as on the previous examples in regard to increased production, which was about three times greater; fewer rejections; and more pieces per grind. The new gap type cutter, in this particular instance, can be obtained for less cost than the hob formerly used.

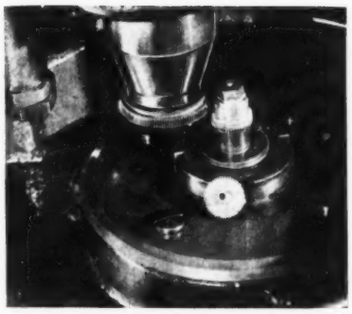




Pull-Down Drive Gear

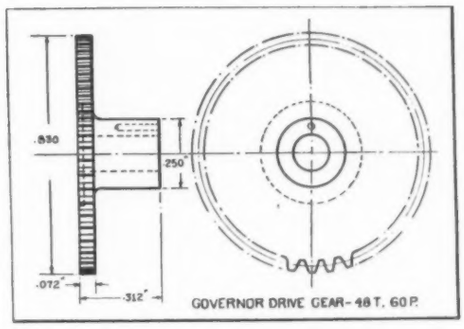
Fig. 9 shows set-up for cutting a pull-down drive gear. The gear blank is formed from steel rod on an automatic screw machine. This is a shoulder gear and only one piece can be cut at a time. On this job, the gap cutter produced twenty times more pieces per grind than the regular cutter. While production was only increased about two-thirds, the saving was greater because of the many pieces cut between grinds of the cutter. The total cost reduction was greater than in the other examples shown.

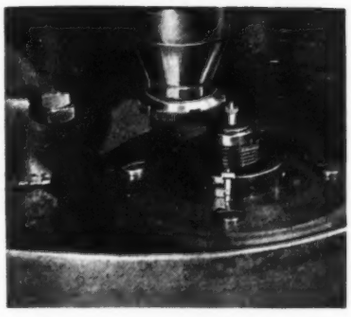




Governor Drive Gear

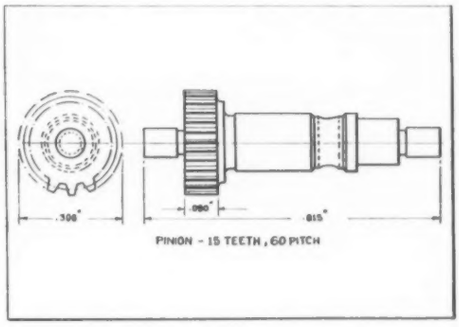
Fig. 10 shows set-up for cutting a governor drive gear made from laminated phenolic material. Two pieces are cut at one setting. Production on this particular part was practically doubled. The tolerance was such that there was very little difference in the gap type cutter and the regular cutter from the standpoint of accuracy. As a matter of fact, the only advantage of the gap type over the regular cutter is increased production.





Governor Drive Pinion

Fig. 11 shows set-up for cutting the mating governor drive pinion, which is made from steel and formed to shape on an automatic screw machine. Owing to the design of this particular part, only one piece can be held at a time. Production was more than doubled, and a very decided saving made in the cost of production.



In the preceding examples, the new gap type cutter, in most cases, has doubled production, and in nearly every instance, has produced gears with greater accuracy, resulting in a decided reduction in rejected parts. The cutter life has also been greatly lengthened, and often ten times as many parts have been cut as with the regular type cutter before the cutter required resharpening. Through the use of this new gap type cutter, thin blanks can be cut at a cost somewhat lower than parts can be produced by punches and dies. On the whole, it can be said that considerable saving in production costs has been effected, as compared with the methods previously employed.

Some Unusual Facts About Tungsten Carbide

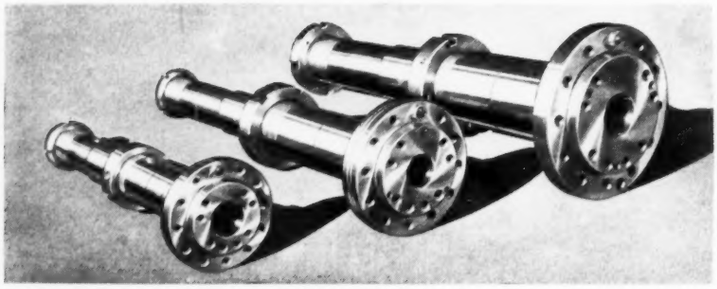
IN a recent radio talk, Dr. Zay Jeffries, chairman of the board of the Carboloy Co., Inc., Detroit, Mich., related some interesting facts pertaining to tungsten carbide. This material was first produced some time in the nineties, when Moissan, a noted French scientist and a pioneer in electric furnace work, produced a compound of tungsten and carbide that was extremely hard. He produced tungsten carbide in a massive form by fusion; but the material was so brittle and fragile that it found no practical use. It took its place on the shelves of scientific curiosities, where it remained with slight disturbance for about twenty-five years.

Most products of the laboratory are made on too small a scale for commercial use. The opposite, however, was the case with Moissan's tungsten carbide; his pieces of this material were much too large. It was not until after 1920 that a German scientist found a way of making tungsten carbide practically useful by producing tungsten carbide in the form of a very fine powder, mixing it with metallic cobalt powder, and pressing the mixture into briquettes which were heated to a high temperature. He was able to find a practical use for cemented carbide. In the final structure of this material, the individual carbide particles may be said to represent building bricks and the cobalt, the mortar or cement holding the bricks together.

One may obtain some idea of the fineness of the little carbide particles, which, of course, are not uniform in size or shape, by considering the fact that a single pound of cemented carbide may contain more than one hundred trillion particles. Of course, no one can really conceive of how many particles that is; but to help the imagination, let us say that the figure represents approximately the number of ordinary building bricks that would be required to build a solid wall 200 feet wide, 1000 feet high, extending clear across the American continent from New York to San Francisco.

Cemented carbide is the hardest metallic tool material known. The harder grades are about three times as hard as hardened tool steel. The cobalt content is varied from about 3 to 13 per cent to obtain different combinations of hardness and toughness. One of the grades of cemented carbide has the highest compressive strength of any known material—890,000 pounds per square inch.

Important New Standards



New Standards for Lathe Spindle Noses, Chucks, and Chuck Jaws have been Approved by the American Standards Association and Technical Societies

Fig. 1. Three Automatic Lathe Spindles Having 6-inch, 8-inch and 11-inch Type A1 American Standard Lathe Spindle Noses

THE new American Standard lathe spindle noses, chucks and chuck jaws for turret lathes and automatic lathes recently approved by the American Standards Association and sponsored by the National Machine Tool Builders' Association, the American Society of Mechanical Engineers, and the Society of Automotive Engineers serve a long-felt want in enabling the machine tool user to obtain interchangeability of chucks and fixtures on different makes of turret lathes, automatic lathes, and engine lathes. These new standards present a great advance in design and performance that will be appreciated, not only by machine tool users but also by machine tool builders throughout industry.

A great deal of credit is due the large number of machine tool builders and chuck manufacturers who cooperated wholeheartedly during the last eight years with the committee who developed these standards. Large expense was incurred during this period by many machine tool manufacturers and a great amount of time was contributed by the committee members in carrying out a piece of painstaking and laborious work.

The object sought in providing these new standards was to furnish a more rigid mounting of chucks and fixtures than was previously available and to provide a degree of accuracy in alignment and interchangeability formerly considered impossible. These standards overcome many long recognized objections to past designs, removing the danger of chucks becoming loose at high speeds if the spindle brake is applied or the spindle reversed, and allow chucks to be changed easily and quickly whenever required.

These new standards were approved by the turret lathe and the automatic lathe groups of the National Machine Tool Builders' Association about two years ago, and are now available on most of the new models of turret lathes and automatic lathes made in this country. In addition, two well-known engine lathe builders are now providing all their engine lathes with these new spindle noses, and most of the other engine lathe builders are in a position to furnish them on request. The new standard chucks are also in production, and can be obtained from most of the chuck manufacturers or, as regular equipment, from any of the machine tool

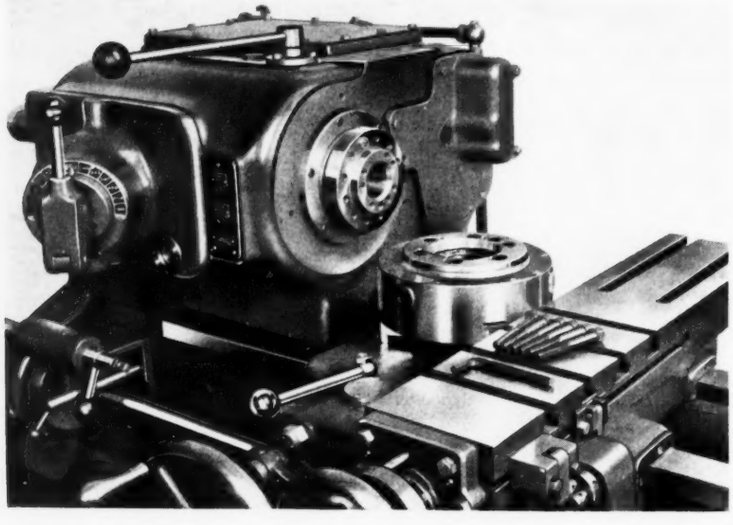


Fig. 2. A Turret Lathe Equipped with a 6-inch Type A1 American Standard Lathe Spindle Nose and a Mating 10-inch Standard Chuck Held to the Spindle Nose by Socket-head Capscrews

for Machine Tools

By
J. E. LOVELY,
Vice-President and Chief Engineer
Jones & Lamson Machine Co., Springfield, Vt.

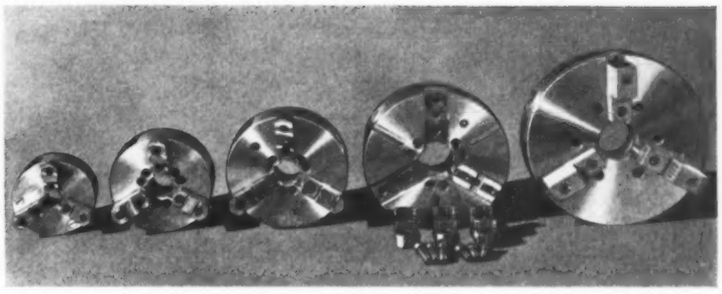


Fig. 3. A Group of American Standard Chucks in 6-, 8-, 10-, 12- and 15-inch Sizes. Sizes from 6 to 36 Inches have been Standardized

builders making machines with the new standard spindles.

Fig. 1 shows a group of spindles having 6-, 8- and 11-inch Type A1 American standard lathe spindle noses. The complete series comprises two spindle noses smaller than those shown and two larger, and covers a range suitable for the smallest to the largest lathes regularly manufactured. The largest nose in the series is known as the 20-inch size and can be provided with holes up to 15 inches in diameter.

Fig. 2 shows a turret lathe equipped with a 6-inch Type A1 spindle nose and the mating 10-inch chuck. The chuck, in this case, is attached by socket-head cap-screws passing through the chuck inside the scroll.

Fig. 4 shows another turret lathe equipped with a 6-inch Type D1 spindle nose and the mating 10-inch chuck. The chuck is the same as that shown in Fig. 2, except that it is held in position on the spindle nose by means of the six cam-lock studs shown projecting from the back of the chuck, which are engaged by cams provided with square sockets in the flange of the spindle nose. This D1 form of nose provides means for quickly changing chucks and fixtures, and is recommended for use when the time required for changing chucks should be kept to a minimum. Both Types A1 and D1 spindle noses have the same diameter taper pilots and the same location of the outer bolt circles, so that chucks and fixtures are interchangeable on both.

All these spindles are provided with a taper pilot, and all fixtures and chucks are made to have a tight fit on the pilot when drawn back against the flat face. This permits the spindle to be reconditioned at any time should the pilot become worn or the face mutilated, because the original size of the taper pilot can be obtained by grinding back on the face and regrinding the pilot.

Fig. 3 shows a group of the new standard chucks in the 6-, 8-, 10-, 12-, and 15-inch sizes. Sizes from 6 to 36 inches in diameter for both medium and heavy duty have been standardized. Both kinds have master jaws of the tongue-and-groove type, and dimensions have been established making the top jaws interchangeable. An extra heavy series of chucks with serrated master jaws has also been standardized. Dimensions have been standardized

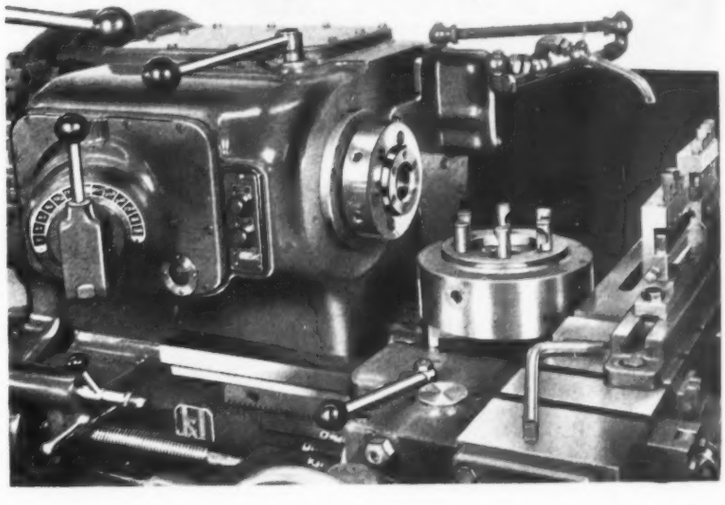


Fig. 4. Another Turret Lathe Equipped with a 6-inch Type D1 American Standard Lathe Spindle Nose and a Mating 10-inch Standard Chuck Held to Spindle Nose by Six Cam-lock Studs

for power-operated and hand-operated chucks of the two-, three-, and four-jaw types. The top jaws are interchangeable on power-operated and hand-operated chucks of the same outside diameter.

The new standard chucks can be mounted directly on the standard lathe spindles without being fitted to the individual spindle. The taper pilot and the flat face on the spindle insures chucks and fixtures running true within a fraction of a thousandth of an inch, even when transferred from one machine to another. The rigid mounting employed is well suited to modern high-production and high-speed requirements.

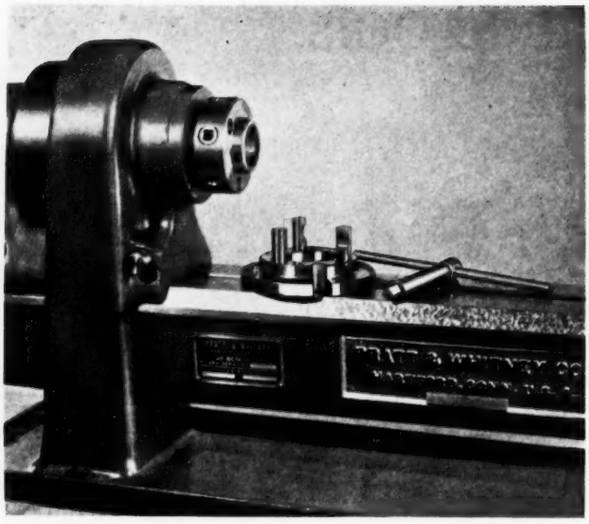


Fig. 5. Application of a Cam-lock Chuck or Faceplate to the Standard Spindle Nose of a Bench Lathe

While these new spindle noses have been approved and accepted for turret lathes and automatic lathes only, the committees that have been engaged in the standardization work believe that they are equally well adapted to engine lathes, and hope that their use will finally be extended to engine lathes by all prominent builders of these machines. The spindle noses can also be used on the work-spindles of grinding machines and on many types of special machines.

Dimensions, specifications, and working tolerances of these new American standard lathe spindle noses are available in a pamphlet entitled "American Standard Lathe Spindle Noses for Turret Lathes and Automatic Lathes—Bulletin ASA B5.9—1936." The new chucks are described in the pamphlet "American Standard Chucks and Chuck Jaws for Turret Lathes and Automatic Lathes — Bulletin ASA B5.8—1936." Both of these pamphlets can be obtained from the American Standards Association or the American Society of Mechanical Engineers, 29 W. 39th St., New York City. The price of the former bulletin is 50 cents, and of the latter, 45 cents.

* * *

At the end of 1936 there were 24,250,000 motor cars and 4,020,000 motor trucks registered in the United States. The world's registration of motor vehicles was 40,000,000, which indicates that approximately 70 per cent of all motor vehicles in the world are operated in this country.

Fig. 6. Cam-lock Chuck Applied to an Engine Lathe with the American Standard Spindle Nose

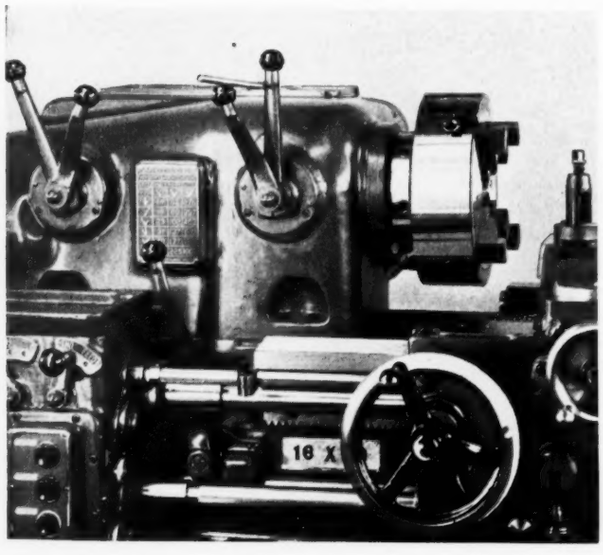
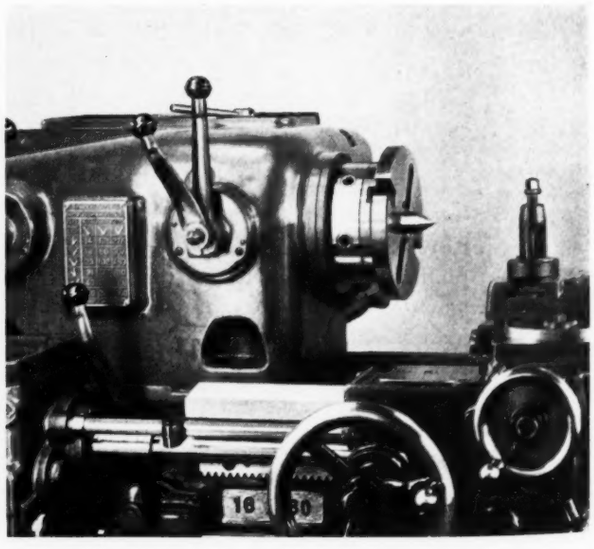
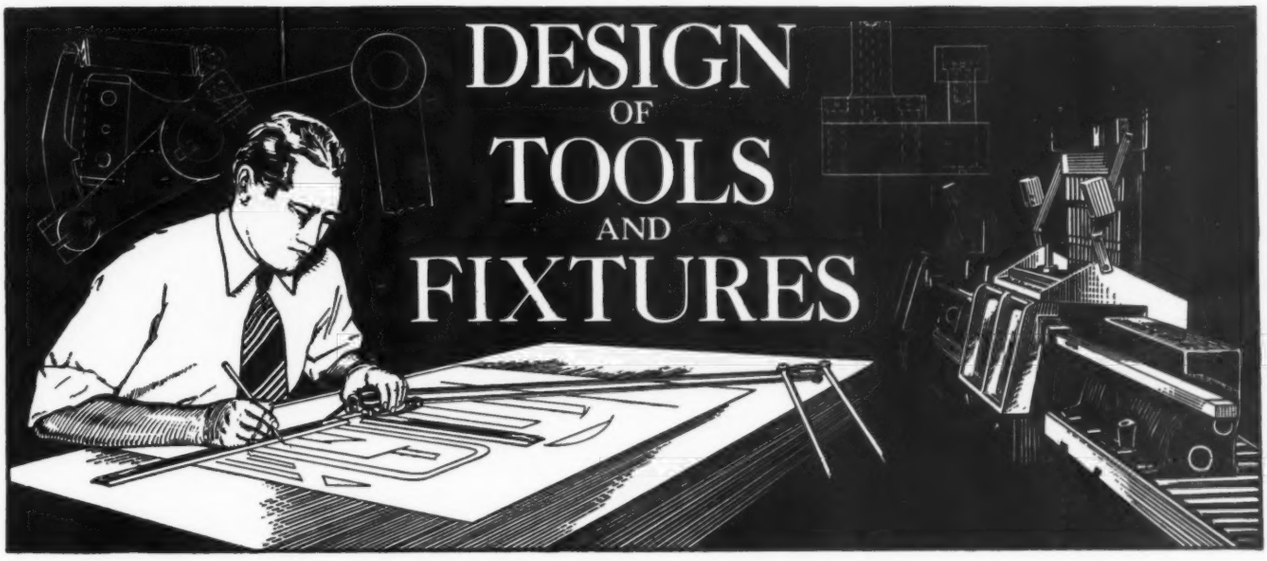


Fig. 7. Cam-lock Faceplate Shown Mounted on the Standard Spindle Nose of an Engine Lathe





Jig for Drilling Evenly Spaced Holes on a Large Circle

By JOSEPH WAITKUS, Wellsville, N. Y.

The drilling and reaming of 113 equally spaced holes on a circle 7 feet 3 5/8 inches in diameter in a drill jig for a certain product presented an interesting problem. To lay out so many holes on such a large circle with any degree of accuracy, obviously requires painstaking care. The work was handled satisfactorily, however, by following the procedure described in the succeeding paragraphs:

Dividing 360 by 113 gives 3.18584 degrees for the angle *H*, Fig. 1, between successive holes. Taking twenty-four holes in a single group, we find that the angle *A* included by these holes is obtained by the equation,

$24 \times 3.18584 =$ 76.46016 degrees or 76 degrees 27 minutes 36.576 seconds

Referring to the diagram Fig. 1, we have a triangle *CDE*, the sides of which are equal to the radius of the circle having a diameter of 7 feet 3 5/8 inches, with an included angle *A* equal to 76 degrees 27 minutes 36.576 seconds. With these two factors we can calculate the length of the chord *CD* which subtends the arc representing twenty-four equal spaces by the following simple equation:

$$CD = 2\left(\text{Radius} \times \text{sine}\ \frac{\text{included angle}}{2}\right)$$

Substituting the known numerical values in this equation, we have

$$CD = 2\ (43.8125 \times 0.61882) = 54.224 \text{ inches}$$

Having calculated the length of the chord *CD*, we set a pair of dividers to this dimension and step off from point *C* in a clockwise direction the five chordal lengths on the circumference, as indicated in Fig. 1, by the long dash and double dot lines. It will be noted that the starting and finishing points thus stepped off overlap an amount indicated by the arc *CF*, which is equivalent to seven spaces.

Next the five arcs subtended by the chords *CD* are subdivided into four equally spaced arcs *CG*, each of which is equivalent to six spaces. The

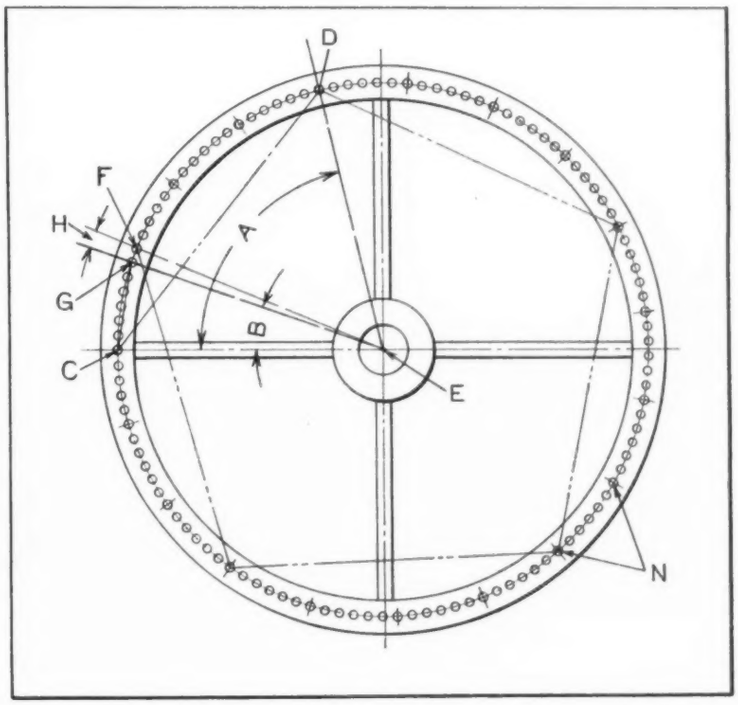


Fig. 1. Drill Jig with 113 Holes Spaced Equally on Circle 7 Feet 3 5/8 Inches in Diameter

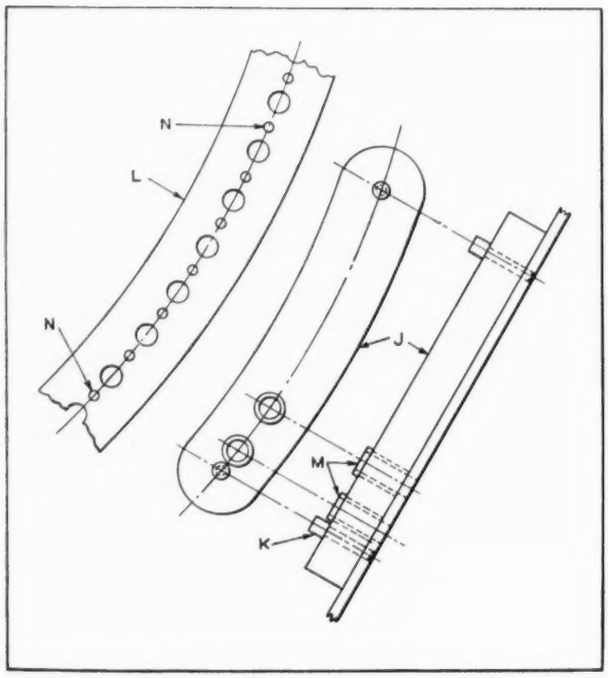


Fig. 2. Drilling and Reaming Bushing Plate J Located on Jig L by Pins K

included angle B of arc CG equals six times the angles between successive holes, or

$$6 \times 3.18584 = 19.11504 \text{ or } 19 \text{ degrees } 6 \text{ minutes } 54.144 \text{ seconds}$$

For the length of the chord CG, we have

$$CG = 2\left(43.8125 \times \text{sine}\frac{19 \text{ deg. } 6 \text{ min. } 54.144 \text{ sec.}}{2}\right)$$
$$= 2(43.8125 \times 0.16616) = 14.559 \text{ inches}$$

Setting a second pair of dividers to the chord dimension just calculated for six equal spaces, we step off this distance in each of the five previous divisions. In this manner, we divide each of the large divisons into four smaller divisions of six spaces each.

In stepping off the six-spaced chord CG, in the space between the starting and finishing point of the five divisions, we obtain the length of the chord from G to F which spans a single space between two successive holes. In other words, as previously mentioned, the starting and finishing point of the five chords CD overlap each other to the amount of seven spaces from C to F. Thus, by stepping off the chord CG in this space, the chord length from G to F is obtained. With this dimension set on a third pair of dividers, it is an easy matter to divide each of the six-spaced arcs into their six equal spaces, thereby completing the division of the circle into 113 equal parts. The simple mathematics and lay-out methods thus simplified what would otherwise have been a rather tedious job involving cut-and-try methods.

The holes thus laid out are simply small guide holes between the large holes in the jig used in the actual production drilling and reaming operations. Arms fastened to a center plate serve to centralize the jig over the work. Since the jig was to be used frequently, it was desirable to maintain the condition of the holes and the accuracy of their spacing as nearly perfect as possible. In order to do this, a drill bushing holder was constructed, as shown at J, Fig. 2.

Guide holes were provided in the bushing-holder J and guide pins K were fitted in these holes for locating the bushing-holder over the main jig, a section of which is shown at L. Bushings M are provided, one for drilling and the other for reaming. The small guide holes N corresponding with those shown in Fig. 1 are six spaces apart, so that the holder J rests steadily on the main jig L. By moving the guide pins K from one guide hole to another, the holes in the bushings M are lined up over the corresponding holes in the main jig member L. One hole can be drilled and the one next to it can be reamed at each setting of the bushing-holder J.

Motor-Driven Turntable for Welding Circular Seams

By A. M. MacFARLAND, Freeport, Ill.

Welding job shops frequently have work requiring the welding of circular seams, but they may not have a sufficient amount of this class of work to warrant the purchase of a regular turntable for rotating the work under an automatic wire-feeding head. However, a turntable that can be built for about $150 and that has proved satisfactory for tank welding work is shown in the accompanying illustration. This device was designed by the writer and has been used with satisfactory results in several shops.

Circular welding can be done many times faster with the aid of a turntable like the one shown than by the ordinary hand welding methods. Also, the weld will be of more uniform quality when a power-driven turntable is used. The turntable shown is adapted for welding light tanks or cylinders having a diameter of 4 feet or less. It can be adjusted to give seam welding speeds of from a few inches per minute up to several feet per minute. It is essential that a turntable for this kind of work maintain a uniform speed. If the speed varies 10 per cent or more, the welding temperature is likely to be too high or too low in spots. A variation in the travel speed has about the same effect as a corresponding variation in the current. Assuming that a welding current of 200 amperes has a variation of 10 per cent, the variation in the current will be about 20 amperes. Probably this variation would be about as large a fluctuation as could be allowed without materially affecting the quality of the weld.

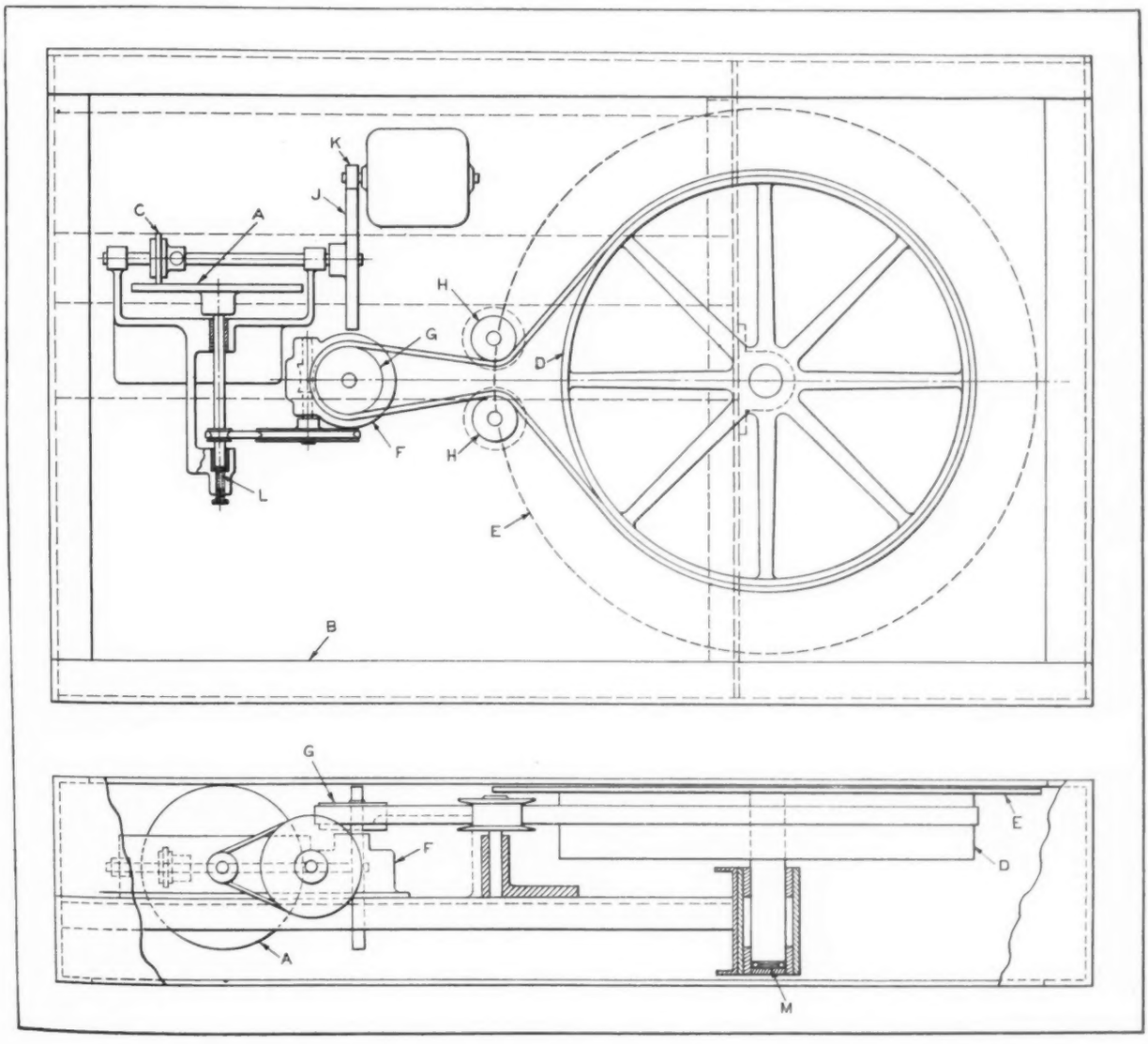
Some shops using automatic traversing machines

have had trouble with their welding equipment without realizing that it was due to excessive speed variation. Frequently, small direct-current variable-speed motors are used and many of these will slow down 20 per cent or more if the load is increased slightly. When such motors are used with field rheostats to control the speed, it is common to find a variation in speed of more than 20 per cent from time to time.

In the device shown, an alternating-current constant-speed motor operating at a speed of 1725 revolutions per minute is used, and speed regulation is obtained by means of a friction disk *A* on the high-speed end of the drive. With such an arrangement, the speed is not altogether constant, but if the device is kept in good order, it will not vary beyond permissible limits. The machine is built with a 12-inch channel frame *B* of light section, bolted or welded together to form a box about 3 1/2 by 5 feet by 12 inches high. The frame surrounds the turntable and is 1/2 inch higher than the table. This arrangement allows the tanks to be rested on the frame and then slid over on the table.

The frame has a top cover over the machinery end with an opening for speed adjustment. If frequent speed changes are necessary, a regulating handle may be brought outside the frame within easy reach of the operator, which will permit shifting the position of the sliding pinion or friction driving wheel *C* on the disk *A*.

The machine is designed to avoid special parts and excessive work in so far as possible. The main turning element is a cast-iron pulley *D*, about 18 inches in diameter, with a 4-inch face, the hub of which is bored for a 2-inch shaft. This pulley has a light cover plate *E* of 1/4- or 3/16-inch steel, cut out with the burning torch and bolted to the spokes of the pulley. The bearing is formed by a stock shaft hanger or pillow block that may be obtained ready babbitted and machined. The pulley *D* is driven by a 1-inch belt from a vertical style, 50 to 1



Motor-driven Turntable E for Rotating Tanks and Other Work Requiring the Welding of Circular Seams

reduction gear *F*. This reduction unit is equipped with Timken bearings and has a 4-inch pulley *G*.

A pair of idler pulleys *H* with wide flanges take up the slack and keep the belt in place. These pulleys also serve to hold the belt around the pulley, giving it a good driving grip. Without the idlers *H*, the belt will cause trouble from slipping. One idler must be pivoted and held against the belt by a strong take-up spring. The reduction gear carries a V-belt drive with a 6-inch pulley driven by a 2-inch pulley on the shaft of the 10-inch friction disk *A*. The 3-inch driving pinion *C* is leather faced and can be adjusted to any point between the center and the periphery of disk *A*.

The pinion shaft carries a 12-pitch gear *J*, 8 inches in diameter, with a 3/4-inch face, which is driven by the motor pinion *K*. The motor pinion may be changed to obtain the major speed changes to adapt the machine for larger or smaller tanks. All the working changes, however, can be made by shifting the friction disk setting. The 1/4-horsepower motor provides sufficient power for operating the table.

The frame for the friction disk consists of structural steel or bars welded together, the main part being a piece of 4- by 4-inch angle. The friction disk *A* is held against the pinion *C* by an adjustable spring incorporated in the thrust bearing at *L*. A ball thrust bearing is also placed under the main table shaft at *M* to take the load of the table and the work.

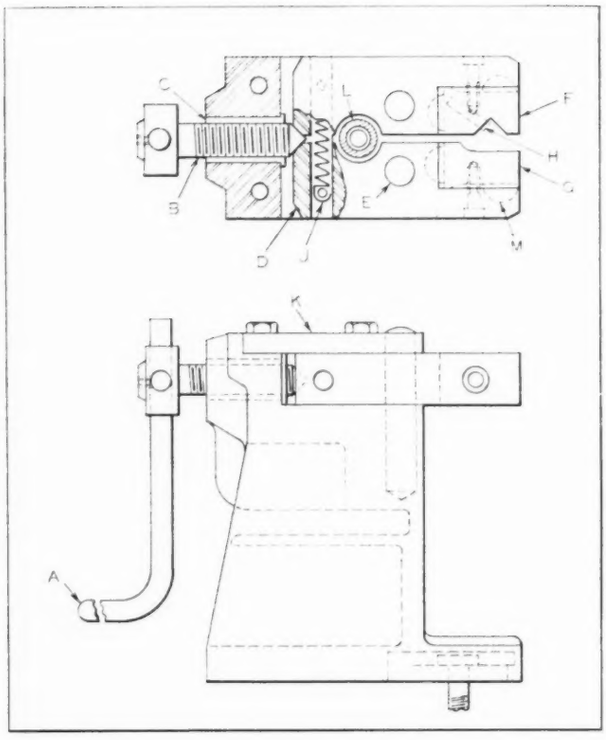
Ordinarily, it is best to mount the welding head on a separate pedestal set on the floor, but it may be attached to the table frame if desired. The motor and friction disk frame are supported by 6- or 8-inch channels, crossing inside the main frame. The entire unit may be adjusted and blocked up at any desired operating angle.

Universal Quick-Acting Tapping Fixture

By H. GOLDBERG, Vice-President
R. G. Haskins Co., Chicago, Ill.

The universal clamping fixture shown in the accompanying illustration provides an efficient means of clamping work in a vertical position for tapping. The fixture is of the self-centering type and is so designed that continuous use does not loosen the two clamping jaws. This feature insures having the work held accurately in the vertical position at all times. Parts from 3/16 to 1 inch in diameter can be accommodated. This range of sizes requires only three sets of jaws. Special jaws for odd-shaped pieces can be made at slight cost.

The work is placed in the fixture from the lower side of the jaws, being pushed up against a stop that is fastened to one of the V-jaws. After the work has been tapped, a slight movement of the handle *A* serves to release the piece, which drops out, leaving the fixture ready for reloading. The



Quick-acting Tapping Fixture for Holding Work up to 1 Inch in Diameter

fixture is very rapid in operation, many small parts being tapped at the rate of 2000 an hour. The production rate depends, of course, on the size of the tap, depth of hole tapped, and shape of part.

In operating the fixture, a slight movement of handle *A* actuates the clamping screw *B* in its bushing *C*. The screw *B* has a wedging action on the two master jaws *D* that swivel on pins *E*, causing the jaws *F* and *G* to grip the work against stop *H*. A slight push on lever *A* releases the clamping action, due to the tension spring *J* which opens the jaws and allows the work to drop out. The top hold-down plate *K* serves to retain the jaws. The spacer *L* supports the top plate, and the Woodruff keys *M* keep the inserted jaws in line with the master jaws.

* * *

January Machinery Exports Reach Highest Value Since 1930

The exports of machinery from the United States during January were valued at approximately $17,300,000, the highest monthly value since 1930, and 19 per cent over the corresponding exports in January, 1936. The January, 1937, exports of power-driven metal-working machinery amounted to slightly over $4,300,000, an increase of 9 per cent over January a year ago. The types of machine tools that showed the most marked increase were turret lathes, milling machines, drilling machines, and sheet metal-working machines.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Complications in the Sale of Machinery

W. C. K.—Recently we offered, by mail, to sell a quantity of machinery to a buyer. Before we received the acceptance we sold the lot to someone else. We immediately wrote and informed the first buyer that we had sold the lot. However, his letter accepting our offer was received by us before our answering letter, in which we withdrew the offer, was delivered to him. Please explain the law with respect to the rights of the parties in such a case.

Answered by Leo T. Parker, Attorney-at-Law
Cincinnati, Ohio

A letter is presumed by the courts to reach the addressee at the time it is delivered to a governmental post office or placed in a mailbox. For this reason, if a seller writes an offer to a buyer who mails a letter accepting the offer before the seller mails another letter withdrawing the offer, then the seller is bound by the original offer. If he cannot or does not fulfill the terms of the contract thus completed, the purchaser may sue and recover damages.

On the other hand, it is important to know that if the prospective purchaser does not positively and unconditionally accept the original offer, the acceptance is not valid; in that case, a contract is not made and the seller may at any time withdraw the proposal. In other words, a valid contract is completed only when the party who receives a proposal accepts it unconditionally.

If a sender proves that he mailed a letter, the Court presumes that the addressee received it. The sender is not required to prove that the addressee received the letter, as he completes his evidence by proving that the letter actually was delivered to a government post office or mailbox.

Blanking Aluminum in Power Presses

O. H.—I would like to obtain some information relating to the blanking of aluminum in power presses, especially on the question of stripping pressures.

A.—The Aluminum Co. of America informs us that, with reasonable attention, no difficulty should be met with in stripping aluminum from punches. In the cooking utensil department of the New Kensington works of this company, a great deal of blanking work is being done. No difficulty has been experienced in selecting suitable sizes of springs for stripping.

The clearance between the punch and die is one of the most important factors affecting stripping pressures. If the clearance is small, the stripping pressure will be high, and vice versa. This is no doubt closely associated with the relation between the clearance and the quality of the sheared edge. Tests made by the Aluminum Research Laboratories a number of years ago indicated that when the clearance between the punch and die was small, the sheared edge became rough and torn. It is reasonable to assume that such a ragged edge is more likely to cling to the punch than a smoothly sheared edge.

These tests also indicated that a considerable amount of clearance is desirable in blanking aluminum and its alloys. A clearance between the two cutting edges of about one-eighth the thickness of the plate to be sheared is recommended. Somewhat less clearance than this is satisfactory for many purposes. The maximum clearance is suggested when it is desired to produce a punched hole which is quite free from burrs or roughness. With this clearance, the punched hole may acquire an appreciable taper if thick material is punched; hence a clearance of less than one-eighth the thickness of the plate may be preferred for some work.

The size and shape of the blanked hole and the amount of material around the hole also seem to have some bearing on the pressure required to strip the metal from the punch. A large rectangular hole or an elliptical hole will require less stripping pressure than a round hole.

Needless to say, the finish of the tools is also important. Tools for blanking aluminum should have smoothly finished surfaces. In use, they should be well lubricated with a lubricant such as mutton tallow or a good grade of metal drawing oil.

* * *

Dust Control Equipment Association Elects Officers

The Dust Control Equipment Association, with offices in the Penton Bldg., Cleveland, Ohio, has elected H. B. Loxterman of the Blaw-Knox Co., Pittsburgh, Pa., president; M. A. Eiben, of the Northern Blower Co., Cleveland, Ohio, vice-president; and Arthur J. Tuscany, of Cleveland, Ohio, executive secretary-treasurer. An engineering committee has been appointed which will develop standards of dust control practice.

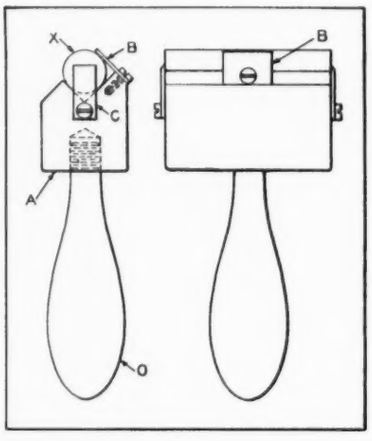
Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Hand Fixture for Grinding Dowels

A simple fixture for grinding dowel-pins which the writer developed for use at the General Electric plant, Erie, Pa., is shown in the accompanying illustration. The dowel holes in dies invariably close in or contract when the dies are hardened, and in most large shops, considerable time is spent in grinding the holes to fit the dowel-pins.

With the type of fixture illustrated, the dowels are dressed off on a large wheel of a wet grinder, so that it is merely necessary to clean out the scale from the dowel holes. The parts *B* and *C* of the fixture are simply pieces of spring stock that hold the dowel-pin in the small V-block. The dowel is ground at point *X*, and the tool is held in the hand by handle *O*, which is threaded in the block *A*. The springs hold the dowel lightly and the pressure of the work on the wheel causes the dowel to turn. The dowels can be ground smooth and to close limits in this way.



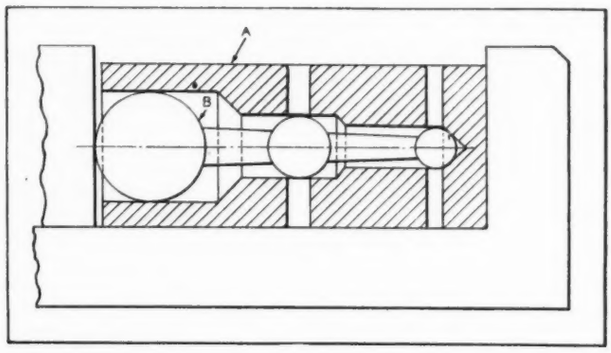
Hand Fixture Used in Grinding Dowels

North East, Pa. LLOYD J. HERRIMAN

Jig Made Entirely in Drilling Machine

The novelty of the jig *A* shown in the accompanying illustration is that it was made entirely on the drilling machine on which it is used for drilling small lots of ball handles of the type shown at *B*. The writer has seen more expensive jigs for this particular work which accomplished their purpose no better than the simple, one-piece jig illustrated.

This jig was made by simply cutting off a piece of square bar stock and drilling one hole in the end to fit the small ball end of the handle *B*, another hole to fit the middle hub, and finally a larger hole to fit the large ball end of the handle. The holes for guiding the drills were next drilled in the side of the bar, after which the bar was casehardened around the drill guide holes. The large ball end of the handle projects from the end of the jig a sufficient amount to permit the work to be clamped in the jig when it is placed in a vise, as shown.



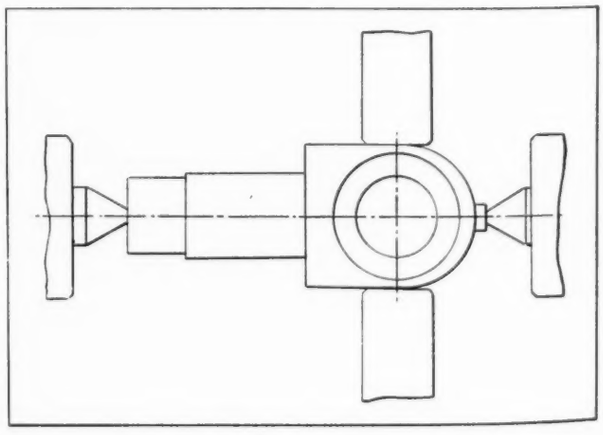
Jig Made in Drilling Machine and Used for Drilling Ball Handle

Ontario, Canada F. MUIR

Centers for Locating Work in Chuck Having Compensating Jaws

Work such as shown in the accompanying illustration, which must be held in a chuck in accurate alignment with the axis of the lathe spindle, even though the sides gripped by the chuck jaws vary in successive units, can be aligned by centers while the compensating jaws are being tightened. One of the centers used in this case is spring-actuated.

Bath, England FRED HORNER



Method of Using Centers to Locate Work in Chuck

A. S. M. E. Plans Meeting in Detroit

THE semi-annual meeting of the American Society of Mechanical Engineers will be held in Detroit, Mich., May 17 to 21, with headquarters at the Statler Hotel. The general theme of the meeting will be the contribution of the automotive industry to industry in general. Because of the part played by automotive practice in the railroad field today, through the adoption of Diesel locomotives, attention will also be paid to this subject in a number of railroad sessions. In addition, there will be a number of technical meetings on power plant engineering and other subjects not directly related to the automotive field.

The machine shop practice division papers will be related to automotive practice, and those on material handling and management will also be directly applicable to the automotive field. Several papers on welding will be presented.

A number of inspection trips have been planned. Chief among the plants to be visited will be the River Rouge plant of the Ford Motor Co., the Great Lakes Steel Corporation's continuous strip mill, the Plymouth division of the Chrysler Corporation, the Chevrolet forge and axle plant, the Packard forge and assembly plant, and the Dodge Brothers body plant.

Contributions Made by the Machine Tool Builders to the Automotive Industry

Among the papers to be presented will be one entitled "Outstanding Contributions Made by the Machine Tool Builders to the Art of Building Automobiles on Mass Production Lines," by F. W. Cedarleaf of the Ex-Cell-O Aircraft & Tool Corporation. In this paper, the author will show how every manufacturer of machinery and tools is affected by the engineering changes and improvements constantly being made in automobiles. He will also touch on the type of machine tools being developed for the aircraft industry.

He will emphasize the importance of machine tool builders sharing their experiences with each other, the same as the automobile manufacturers do. Such sharing of experience in the automobile field has been of great importance in the rapid development of the automobile. He will also point out that many new developments in machine tools have been made in answer to the automotive engineers' demand that next year's car should be a better car at a lower cost. The author will conclude his paper by pointing out that the machine tool builder's greatest contribution to the automobile industry has been the development of high-production machines having tool-room accuracy.

In his paper "A Study of Lip Clearance on Twist Drills," Charles J. Starr, associate in mechanical engineering at the University of Illinois, will discuss the lip clearance on twist drills as produced by five makes of drill-sharpening machines. He will also describe a special measuring machine that has been devised to obtain the actual contour of lip clearance surfaces, and will show curves plotted from dynamometer tests to show the power required to operate drills with different lip clearances.

Among other papers to be presented at the meeting is one entitled "Rubber Cushioning Devices," by C. F. Hirshfeld, chief of the research department of the Detroit Edison Co., in collaboration with E. H. Piron, engineer of the Transit Research Corporation. In this paper, springs of steel and springs of rubber are compared, and the conclusion is drawn that neither can completely replace the other, each being required in certain cases.

"Production and Quality Control of Sheets for Auto Body Fabrication" will be the subject of a paper presented by T. F. Olt, supervising metallurgical engineer of the American Rolling Mill Co.

Influence of Automotive Practice on Bearing Design

Albert B. Willi, engineer with the Federal-Mogul Corporation, will read a paper on the subject "Industrial Bearing Design as Influenced by Automotive Practice." This paper will deal mainly with split bearings of the general type commonly used for main and connecting-rod bearings in automotive design. Bearing materials will be discussed, including babbitts and the newer copper-lead and cadmium-silver bearings. Lower costs are generally obtained with these newer types, since much less babbitt is required for the bearing, and fewer operations are needed for its machining.

Among other papers to be presented are the following: "The Contribution of Broaching to the Automotive Industry," by Sol Einstein, vice-president and chief engineer, and Millard Romaine, mechanical engineer, of the Cincinnati Milling Machine Co.; "Recent Developments in the Basic Processes of Fabrication," by William S. Knudsen, executive vice-president, General Motors Corporation; "Hydromatic Welding of Frames," by C. L. Eksergian, chief engineer of the Budd Wheel Co.; "Welded Steel in High-Speed Railway Service," by Everett Chapman, president, Lukenweld, Inc.; "The Automobile Industry and the Young Engineer," by C. J. Freund, Dean of the College of Engineering, University of Detroit; "The Decentralization of Industry," by W. J. Cameron, Ford Motor Co.; and "The Grinding of Cemented-Carbide Milling Cutters," by Hans Ernst, research engineer, and M. Kronenberg, engineer, the Cincinnati Milling Machine Co. R. C. Deale, of the E. W. Bliss Co., will present a report of the Subcommittee on Metal Cutting Data, for reducing production costs by the more effective use of metal cutting tools.

Methods that Produce a

Machine Tools are Given a Better Paint Finish than Most Other Types of Machinery. The Practice of a Well-Known Machine Tool Builder is Recorded in This Article

By VERNE C. SESLAR, Supervisor
Painting and Finishing Department
The Cincinnati Milling Machine Co.
Cincinnati, Ohio

Applying the Primer Coat to Castings in the Spray Booth in the Foundry

A WELL painted machine has an added sales value. This applies to machinery in general, but is especially true of machine tools. Even though the machine tool buyer be a very matter-of-fact and prosaic person, the good-looking machine is likely to appeal to him—all other things being equal. Its neat appearance makes the customer proud to have it in his shop. A good paint job also has a definite practical value; it prevents rust and corrosion and aids in keeping the machines neat and clean.

At the plant of the Cincinnati Milling Machine Co., the first step in obtaining a properly painted machine is taken in the foundry. The work begins with the casting after it has been cleaned. It is then sent to a spray booth where the inside is painted red to prevent rust. Next, a coat of primer is sprayed over the outside. It is important that there be no grease or dirt on the surface previous to spraying the primer coat. If there is, it will cause the paint to chip off. Small castings which can be handled by hand are dipped instead of being sprayed.

After drying two hours, the casting goes to the filling department. Large castings are filled with a glazing knife; small ones, with a brush. The subsequent drying requires an hour and the castings are then ready for the yellow guide coat of water color. The object of putting on this guide coat is to assist the sanders in obtaining a smooth and even surface.

Following this, the casting is allowed to dry for about five hours, and it is then ready to be sanded. The sander knows that when he has removed the yellow paint, the machine is well sanded. In the sanding process, a rubber block is used, around which the sandpaper is wrapped, instead of the traditional wooden block. By using a rubber block it is possible to obtain a more even surface, since it will adjust itself to the rough places.

After the sanding operation, the castings are run on conveyors through the spray booth, where they are coated with gray sealer. The sealer protects the filler during the machining operations, when oil is likely to drop on the castings, soak into the filler, and form oil-pockets.

The castings now leave the foundry division of the painting department and pass through the machining and assembling processes. When a machine has been completely assembled, it is delivered to the finish-painting department, located adjacent to the shipping department. Here the machines are first washed with naphtha to remove all grease and oil; then the two painters who take the machine from the machine shop and who follow it completely through the painting operations start their work. The first operation is that of "filling."

The machining process leaves nicks in the surface which must be removed with a lacquer filler. While the filler is drying, the bright parts are taped and the bearings are covered with grease so that the grit from the sandpaper will not get into the bearings and slides. Then the filler is sanded and the first sealer coat applied. When this work has been inspected, two more lacquer coats are applied. Small parts, such as handwheels, handles, braces, etc., are painted carefully by hand while the lacquer is drying on the machine.

High-Grade Paint Job

When everything has dried, the machine is "gas-sanded" by dipping sandpaper into gasoline and rubbing it over the machine. Gasoline prevents scratching of the surface, acts as a cutting solution, and produces a much better finish.

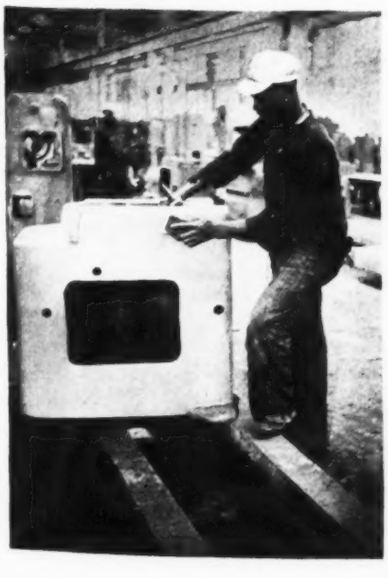
One last coat of gray lacquer is then sprayed on the machine, which is now ready for the final clean-up. The grease and tape used to protect the finished surfaces are removed. The machine is "rough-cleaned" with naphtha; next it is finish-cleaned by going over the polished parts with a lacquer-thinner to remove all grease or paint. The bearings are then immediately coated with a light thin oil to prevent rusting, the small parts are assembled in place on the machine, and the finished machine is delivered to the shipping floor for final inspection.

Finish-painting Machines in Spray Booth, thus Completing the Painting Job

All machines, unless otherwise specified by the customer, are painted with a "standard gray"—"machine tool gray," as it is called since it was adopted by the machine tool industry as a standard several years ago.

An important feature of a well equipped paint shop is proper spray booths. Where there is paint there are always fumes, and the spray booth should eliminate these fumes. In the Cincinnati Milling Machine Co.'s paint shop, five fans are placed between two perforated plates of steel which line the walls of the spray booth. These fans suck the fumes from the booth and pass them out into the open air. The booth has a fireproof glass top and two doors which drop automatically in front of the booth in case of fire; otherwise, these doors remain

Sanding the Castings, Using a Rubber Block around which the Sandpaper is Wrapped



Applying the Sealer to Protect the Filler During the Machining Operations

"Filling" the Surface of a Casting in the Finish-painting Department

open. A separate exit is provided from the booth in case a man should be working in it when a fire started.

Great progress has been made in recent years in the painting of machines of all types. Years ago machines frequently received but one coat of paint. When better finishes were demanded, a filler was applied after the machine was assembled, before painting. The process often required an entire week in the paint shop. Then lacquer finishes were developed and better spray guns produced, so that today it is possible to finish-paint a machine in from five to eight hours.

* * *

What One Employer Has to Say on Industrial Espionage

We have received the following letter from an employer in the mechanical industries who has always maintained friendly relations with his employes, who carried many of them through the depression at a considerable financial sacrifice, and who is known for his progressive attitude on labor questions. This is what he writes:

"I have not read more than snatches of the testimony of the industrialists before the LaFollette Committee. What I have read, however, makes me wonder if those who testified succeeded in making it clear why employers so often try to find out what their employes are thinking. It seems to me that some courageous industrialists might well have testified somewhat as follows:

'Gentlemen, I do not know how many of the members of your committee ever employed men in groups, but if any have, they will know from experience that the most difficult thing about their task is to get the real facts about what the employes think of their jobs. The employe will complain about the smallest thing to his fellow-workmen, but will never 'make a peep' about it to anyone in authority who has the power to correct the situation. I will wager that 95 per cent of the complaints of industrial workers could be ironed out almost instantly if the management knew what they were.

'Labor leaders know this peculiarity of human nature and glory in it. In fact, it is one of the sources of their power. They do not want the employe to discuss his grievances with the employer. They want the employe to report to them, so that they can build up a case against the employer, demand a settlement, and, getting it, brag about it to the employe. By this means the labor leader can show the employe what he is getting for his dues, and keep him a paying member of the union.

'I ask you, gentlemen, if it is wrong for an employer in honesty to try to find out what his employes are thinking and what their grievances are, so that he can correct the causes? If it is this kind of espionage that your committee objects to, I, for one, am an employer that would not agree with you. Furthermore, I do not for one moment believe that this sort of effort on the part of an employer—to remove causes for friction before they become old sores—is inimical either to the public interest or the interest of the employes.

'You do not make for good employer-employe relations by denying contacts between employers and employes. Employes naturally do not like to carry picayune complaints to their employers; yet it is just such complaints that, if allowed to fester and grow, often develop into major difficulties.

'It seems to me that the employer who tries to find out what these complaints are in a desire to eliminate them, should be applauded and not condemned; yet as I construe the attitude of this committee, it is suspicious of every type of effort of this kind on the part of employers, and tries to give the impression to the public that it is, in fact, a sneaking, underhanded practice. This, in my judgment, is unjust and wrong, and inimical to the very interests that you yould have the public believe it is your desire to protect.'"

Prize Winners for Articles on Ingenious Mechanisms

In MACHINERY'S prize contest for the sixteen best articles on ingenious mechanisms, the following prizes have been awarded, in addition to regular space rates paid for the articles.

Two First Prizes:

J. J. Pesqueira, New York City
William Shaw, Providence, R. I.

Four Second Prizes:

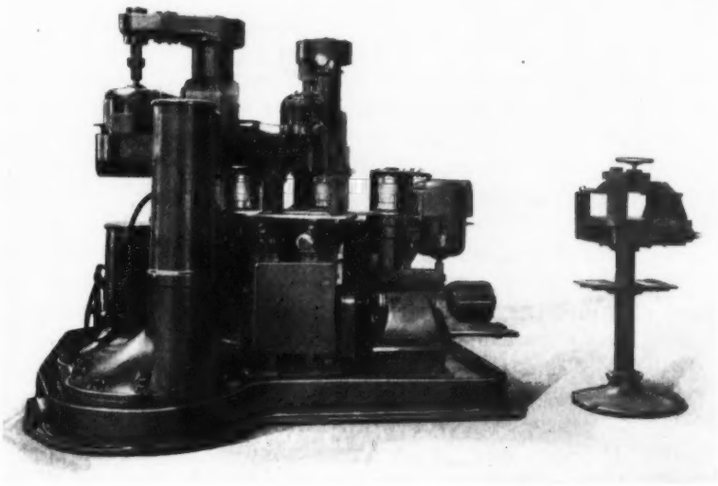
Charles H. Haggerty, Providence, R. I.
A. R. Kligman, Indian Orchard, Mass.
Donald S. Warner, North Adams, Mass.
I. F. Yeoman, Elkhart, Ind.

Ten Third Prizes:

T. Getaz, Bern, Switzerland
Robert W. Huxtable, Orange, Mass.
M. Jacker, Oakland, Calif.
Louis Kasper, Philadelphia, Pa.
Frank H. Mayoh, Springfield, Mass.
Gerould R. McWane, Sandusky, Ohio
A. A. Neff, Chicago, Ill.
David E. Patterson, Philadelphia, Pa.
William H. Pellett, Windsor, Ont., Canada
James H. Rodgers, Toronto, Ont., Canada

Grinding the Contour of Door Glass

Twenty-one pieces of automobile door glass cut from safety glass or forty-eight pieces cut from ordinary plate glass can be ground simultaneously around the top and two ends by the machine here illustrated, which was recently built by the Foster Machine Co., Elkhart, Ind. The bottom of the glass does not require grinding, as it can be cut sufficiently accurate with a diamond or other means.



One of a Battery of Machines Recently Built by the Foster Machine Co. for Grinding the Contour of Automobile Door Glass at High Rates of Production

Two cams proportioned to the required contour of the door glass are mounted opposite each other on the revolving table. The glass is loaded into a fixture before being placed on the machine, a loading stand being seen at the right in the illustration. A loaded fixture can be set up on one side of the table while glass on the other side is being ground, so that the production is continuous. Pneumatic clamps hold the loaded fixtures securely in place on the table.

Four cylinder-like grinding wheels work at the same time on the stack of door glass. Each wheel-head is supported on a swinging arm and is provided with a collar that is held in contact with the cams on the revolving table. By this means, the grinding wheels are guided to generate the correct contour.

The machine is operated at a table speed of one revolution every thirteen minutes, so that safety glass is finish-ground at the rate of three pieces in slightly less than one minute. while plate glass is finish-ground at the rate of seven pieces in less than one minute.

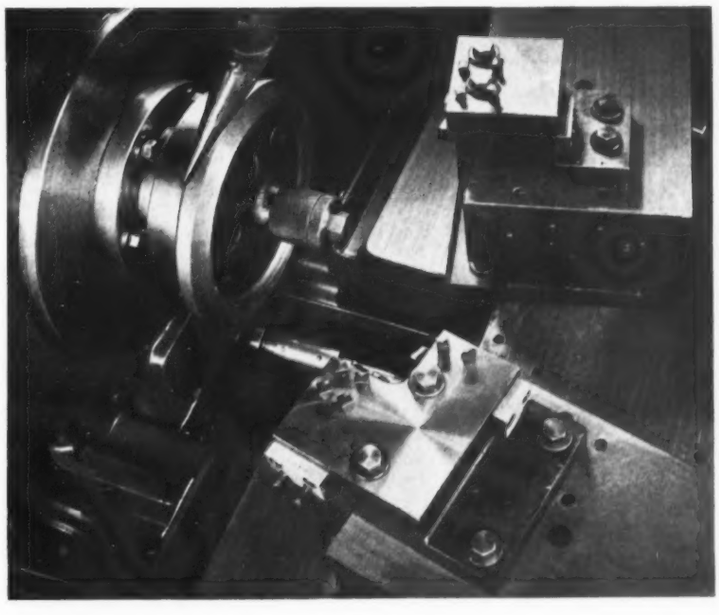
High-Speed Machining of Bevel Gears

Five different sizes of bevel gears for automobiles are being completed at an average rate of twenty-eight an hour in three operations performed on Simplimatics built by the Gisholt Machine Co., Madison, Wis. The three machines are operated by one man.

The first operation consists of rough- and finish-facing the back side of the gear, boring from that side, and chamfering the outer edge. The second operation, in which the gear is located from the bore, consists of rough-turning, boring, facing, and chamfering the tooth side of the gear blank, as shown in the illustration. In the third operation, finishing cuts on the tooth side are taken by tools arranged in the same manner as the tools provided for the second operation.

In all three operations, the tools are held in simple blocks, mounted on standard slides. Several sizes of gears can generally be handled by merely changing the positions of the tools, but occasionally, a change in the tool-blocks is required. The gear blanks are held securely by fixtures that are pneumatically actuated.

Stock to a depth of approximately 1/16 inch is removed in the various cuts at a speed of about 210 surface feet per minute. The maximum feed is 0.019 inch per revolution of the work. The machine cycle is entirely automatic after the operator has started the machine.



Tooling Used in Second Operation Performed on Bevel Gears in a Gisholt Simplimatic

Exhibition of General Electric Co.'s Products

Products of the General Electric Co. and its affiliates that are intended for industrial applications are being effectively displayed at an exhibit opened on April 5 in the General Electric Building, 570 Lexington Ave., New York City. This exhibit occupies 7000 square feet of floor space. Much of the equipment shown is in actual operation. For instance, three arc-welding sets are being demonstrated, welding being performed inside a booth. A generator voltage regulator is in operation, so that visitors can see the stabilizing effect of a regulator during voltage surges. Three induction voltage regulators are also demonstrated, as well as the effect of voltage regulation on power and distribution lines.

Assembled and completely disassembled motors comprise a considerable portion of the exhibit. Photographs show various tests through which the motors built by the company must pass during manufacture. One of the exhibits is an induction motor within a glass enclosure which runs in cement dust blown about by a vacuum blower. Industrial controllers constitute another important display, as well as a large variety of parts that have been annealed, normalized, hardened, brazed, etc., in electric furnaces. Different types of illumination are used to demonstrate good industrial and commercial lighting.

Besides products of the Incandescent Lamp Department, Air Conditioning Department, Construction Material Division and Plastics Division of the Appliance and Merchandise Department, are shown products of the Trumbull Electric Co., General Electric X-Ray Corporation, Warren Telechron Clock Co., General Electric Vapor Lamp Co., Bailey Meter Co., Locke Insulator Corporation, and Carboloy Co.

General View of Electrical Motors and Switches on Display at the Exhibit of the General Electric Co. in New York City

The Effect of Machinery on Working Hours

Some of us can remember when 72 hours was considered a normal working week. Practically all of us have experienced the 60-hour week, gradually followed by the 55- and the 48-hour week. This reduction in hours was accompanied by continuous improvements in machines and processes. It was these improvements that made a shorter working week possible.

At the present time, we hear a great deal about the 40-hour week and have heard about it for some years. Here and there the 30-hour week has been proposed. There is, however, a well founded opinion that we are not yet ready for a 30-hour week. Even radical labor leaders admit that. True, some of them advocate it—but they do it only as a matter of establishing a trading position, not because they really think it is sound. In their private conversations, and occasionally in public, they admit that they think it is unsound at this time; but the 40-hour week is an accomplished fact.

If this 40-hour week is to be placed on a really sound basis, improvements in machines and processes must continue. This is the only way in which to produce efficiently, so as to maintain our standard of living although working hours are reduced.—*R. L. Rickwood, Superintendent, Blanchard Machine Co., Cambridge, Mass., before the Boston Branch of the National Metal Trades Association*

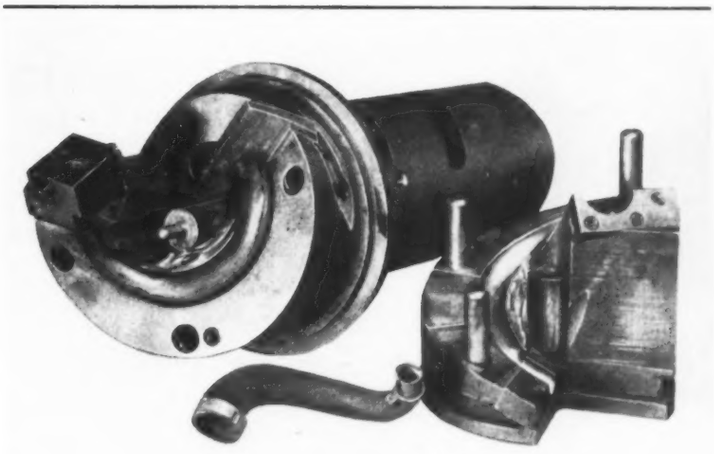
* * *

The Blueprints Back of the Automobile

The vast amount of preliminary work involved in the building of a modern automobile is seldom appreciated, even by the average well informed mechanic. That there is a tremendous amount of engineering and tool designing work necessary before a new model can be built is, of course, well understood; but who would think that before a new Buick car can be built, for example, something like 350,000 blueprints have to be made? The blueprint room of the Buick plant is practically a production plant in itself, constantly running off the tens of thousands of blueprints necessary in every phase of car production. Adjacent to this blueprint room is the 40- by 60-foot fireproof vault in which are filed the drawings that record the engineering history of the Buick car. Here are stored all the drawings of the Buick cars from the first two-cylinder "horseless carriage," of which the company built thirty-seven in 1904, to the new 1937 models, of which the company expects to build more than 200,000.

Automatic Die-Casting Die with a Long Helical Core

Ingenious Die that Produces in One Operation a Phonograph Arm Similar to One Drawn, Expanded, and Annealed in Twenty-Two Operations



FIVE years ago an article was published in MACHINERY (April, 1932, page 604) that described an ingenious method of drawing, bulging, and bending helical tone arms for phonographs from disks of sheet brass. Eight distinct drawing operations, one bending operation, two bulging operations, and a cutting-off operation were required to shape the part. In addition, annealing was necessary after each of these operations, except when the part was cut to length, making a total of twenty-two operations.

Phonograph tone arms of similar shape are now being produced from zinc in one operation by employing the die-casting process. Dies of unusual construction, as seen in the illustration, are necessary in order to cast the helical form. These dies were designed and made by W. P. Pondelicek of E. Toman & Co., Chicago, Ill. The imaginary center line of the arm follows a helix 3 1/2 inches in diameter, of 7 1/4 inches pitch. The wall thickness tapers from 0.110 to 0.080 inch.

Since the phonograph arm is a true helix, it can be cored the full length by means of a core that is advanced 13 inches into the die cavity through a combined rotary and longitudinal movement of the core-holder. Spur gear teeth cut in a helical path around the periphery of the core-holder provide a means of rotating it through the use of a gear-tooth rack. When the core-holder is revolved, it is also moved longitudinally as four hardened rollers attached to the core-holder engage a helical cam slot in the core-holder bearing.

When the core is in place for an operation, the small outer end is supported and accurately located by means of a dowel-pin. At the end of an operation, the core must be completely withdrawn before push-pin ejectors can be actuated in the die cavity.

The main die parts, the helical core, the core-holder, and the core-holder bearing are all made of Truform oil-hardening alloy steel, a product of the Jessop Steel Co., Washington, Pa. The parting line of the dies follows the helical center line of the die cavity and of the core. The parting line was cut on a milling machine by employing extra long end-mills, the die parts being clamped on the faceplate of a dividing head. In this operation, the work was periodically indexed 1/2 degree, and with each indexing, it was fed the required amount toward the end-mill by turning the handwheel on the micrometer screw of the milling machine table. The graduated dial on the table screw facilitated accurate feed movements. When the parting line on both dies was finished to a close fit, holes were bored for three liner pins that were afterward assembled to one of the die halves.

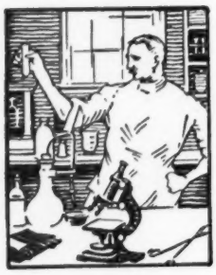
The cavity was cut in both die halves by means of a ball cutter. In taking roughing and finishing cuts, each half was dotted approximately five thousand times with this cutter. An accurately bored half bearing was mounted at each end of the die cavity to serve as a guide in this generating method and assure a gradual taper of the helical path.

In this operation, the milling cutter was mounted in the spindle of one horizontal milling machine and the die parts were mounted on a dividing head fastened to the table of a second horizontal milling machine. The second milling machine table was connected to the table of the first machine and was positioned in the same relation to it as the helix angle of the die-casting die. For each cut taken with the ball cutter, it was necessary to index the dividing head and move the two tables.

The helical core was produced from a tubular forging of alloy steel, which was generated in the same manner as the die cavity by taking approximately five thousand roughing and finishing "dots" or cuts. It was then fitted to the die and polished.

After a run of 40,000 die-castings, the core and other die parts were in as good condition as when new, there being no signs of distortion or checking.

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

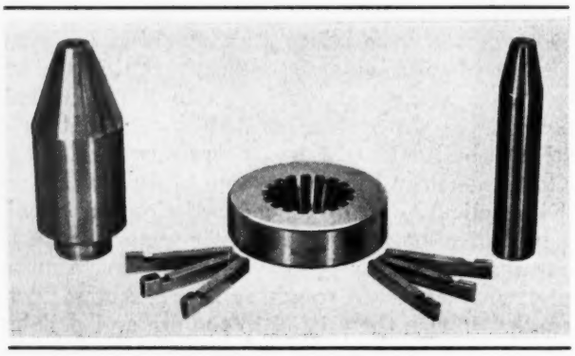
Timken Graphitic Steel Advantageous for Tools and Dies

An alloy steel in which part of the carbon contained is in the form of free graphite is being placed on the market by the Timken Steel and Tube Division of the Timken Roller Bearing Co., Canton, Ohio, after a period of development covering several years. This alloy combines the more desirable features of cast iron with the high strength of steel. It can be hot-worked into billets, bars, wire, seamless tubing, sheet strip, rings, etc., and by introducing refinements in the standard process of manufacture, properties can be produced that adapt the steel especially for use in making various types of dies and punches.

One of the primary advantages of this graphitic steel is the ease with which it can be hot-rolled and forged at temperatures not exceeding 2000 degrees F. Ease of machining is another characteristic, the steel being of the same free-cutting nature as cast iron, because of the free graphite. High surface hardness is obtained through a simple heat-treatment which facilitates the making of punches and dies in one piece.

Unusual resistance to wear is afforded, because the free graphite acts as a retainer for lubricant. It also eliminates scoring and scuffing of the parts produced. High resistance to impacts is another feature which adapts the steel for metal-forming parts that are subjected to severe service. Graphitic steel may be welded satisfactorily by the resistance flash method. It will air-harden during cooling, and therefore, a normalizing or annealing treatment is recommended after welding to relieve internal stresses.

For the majority of tools and dies, this steel is supplied in a water-hardening grade termed "Graph-sil," the application of which is limited to sections that are reasonably uniform throughout and parts on which a suitable amount of stock can be left for machining or grinding to finished dimensions after heat-treatment. For dies and tools that are of non-uniform section and must come from the heat-treatment without appreciable change in dimensions, there is an oil-hardening grade known as "Graph-mo." This steel responds readily to heat-treatment from a relatively low temperature, and possesses improved physical properties that are obtained without the loss of the free-machining characteristics.



Timken Graphitic Steel is Suitable for Punches and Dies of Various Sizes and Shapes

Oldsmobile Radiator Grilles are Zinc Die-Castings

The striking radiator grille which adorns the front end of this year's Oldsmobile Six is constructed of a number of chromium-plated zinc die-castings, instead of being fabricated from stainless steel as mentioned in April MACHINERY. Each of the curved radiator louvers comprises a separate die-casting.

Stainless steel is used on these automobiles for the louvers of the hood panels and for other decorative trimming.

Nickel-Copper Alloys Used for a Variety of Purposes

In a recent address before the New Jersey chapter of the American Society for Metals, F. L. LaQue, of the International Nickel Co., dealt with the applications of copper-nickel alloys. These alloys, containing from 20 to 30 per cent nickel, have good

mechanical properties and resistance to corrosion. They are used principally for boiler and condenser tubes. Alloys containing up to 45 per cent nickel have found wide application in the form of wire for electrical purposes, and are of great value in the construction of resistances for speed and voltage regulators. In the form of sheets, bars, and tubes, alloys with a 45 per cent nickel content are also used extensively for ornamental and architectural purposes. Their silvery-white appearance and resistance to corrosion have also led to their employment for tableware and bathroom fittings.

Nickel-bronze alloys, containing from 50 to 70 per cent nickel and up to 10 per cent tin, are used extensively for valve parts, where strength must be retained at high temperatures and where resistance to corrosion and erosion is a property of primary importance.

Copper-nickel alloys in the nickel-silver group, also known as white bronzes, contain from 8 to 30 per cent nickel, together with copper, tin, zinc, and lead. The beauty and endurance of these alloys have made them widely used for metal trim, hardware, plumbing fittings, etc. These alloys, having no plated or coated surfaces to wear or peel off, are widely used in the building field.

"Speed Treat" Free-Machining Steels of Medium-Carbon Range

Research activities conducted by the Monarch Steel Co., Indianapolis, Ind., on "Speed Case" free-machining steel since its introduction on the market several years ago, with a view to obtaining improved physical properties without sacrificing its free-machining characteristics, led the concern to believe that a steel of the same type could be produced in higher carbon ranges. "Speed Case" is an open-hearth casehardening steel with good physical properties, including both strength and ductility, which can be machined faster than S A E 1112 Bessemer screw stock. It can be machined at over 200 surface feet a minute, and is so ductile that a 1-inch round cold-drawn bar can be bent flat on itself or tied into a knot and pulled tight without a sign of fracture. At the same time, this steel possesses the ability to withstand severe cold-forming, crimping, rolling, or bending operations.

Subsequently, the concern brought out a steel known as "Speed Treat X-1535" which has a carbon content of 0.30 to 0.40 per cent. This is also an open-hearth steel which has considerably more strength than "Speed Case" and yet can be machined at a surface speed of 150 feet a minute. The tensile strength is approximately 95,000 pounds per square inch. This steel also is ductile enough to be bent flat on itself in the cold-drawn condition without fracturing.

The company has now brought out "Speed Treat X-1545," which is a 0.40 to 0.50 per cent carbon open-hearth steel having a tensile strength of 110,000 pounds per square inch. This steel can be machined almost as fast as S A E 1112 Bessemer screw stock. The two "Speed Treat" steels respond readily to heat-treatment.

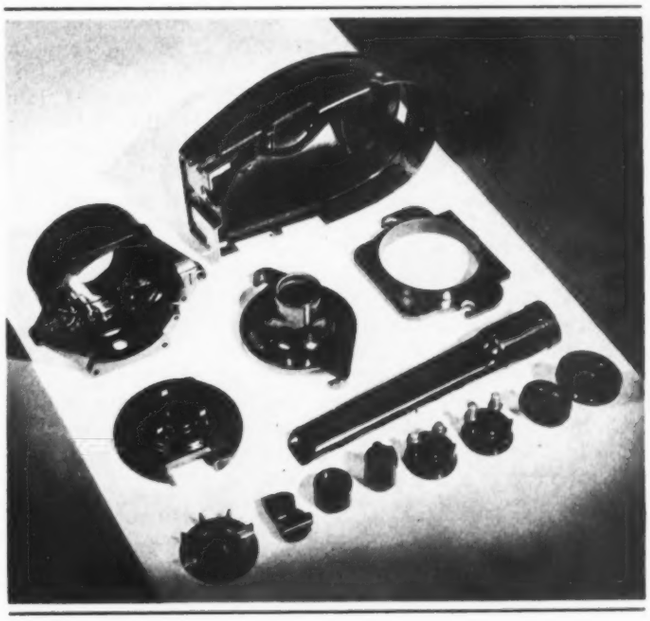
New Materials Reduce Weight of Vacuum Cleaner

Modern appearance and light weight have been achieved in the Hoover Model One Fifty vacuum cleaner through the use of special Bakelite molding materials in combination with aluminum and magnesium alloys. The weight is 20 per cent less than that of previous models.

The motor hood, motor case, ventilating fan, agitator ends, bag connector, and other small parts are made of Bakelite moldings. All together, there are eleven molded parts in the cleaner itself, weighing a total of 1.7 pounds, and in addition, several molded parts are supplied with the cleaning tools. An idea of the range in size and design of these molded parts will be obtained from the illustration.

These molded plastic parts have a permanent color and luster and possess electrical insulating properties. The use of molded plastics enables complicated shapes to be easily produced. The hood was produced from a special material of extra strength, and it is reinforced with ribs on the inside. The colors of the vacuum cleaner are stratosphere gray and clear blue.

The body of the cleaner, chassis, bottom plate, fan, and handle ball are die-castings.



Bakelite Molded Parts Used in the Hoover One Fifty Vacuum Cleaner

NEW TRADE LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies can be Obtained by Writing Directly to the Manufacturer

Haynes Stellite J-Metal

HAYNES STELLITE CO., UNIT OF UNION CARBIDE & CARBON CORPORATION, Kokomo, Ind. Booklet entitled "Haynes Stellite J-Metal Cutting Tools," containing 52 pages and over sixty illustrations of tools and machining operations. Information is given on how to obtain the best results in machining cast iron, malleable iron, and most steels with J-metal tools; speeds and feeds for machining a variety of materials; methods of obtaining longer tool life; and proper tool grinding practices. An extensive table of grinding wheels enables the user to select quickly the proper wheel for any specific tool grinding operation. In addition, complete tables are included that indicate the conditions under which Haynes Stellite J-metal is being operated on specific turning, facing, boring, and milling jobs. Another section of the book contains a concise summary of hard-facing applications in the machine shop.

Steel

UNION DRAWN STEEL CO., Massillon, Ohio. New edition of the "Steel Handbook for Machine Tool Users," a compilation of data designed to aid those whose business involves the machining of bar steel in selecting the proper steel grade and developing the highest efficiency in working it. The book consists of seventy-two pages covering such information as physical properties of cold-drawn steels, cutting speeds and feeds for various grades of steel on automatic screw machines, and cutting speeds and feeds for standard tools. Material and time estimate tables for automatic screw machine production, spindle speed tables, drill data, and other information of use to the automatic screw machine operator and set-up men are included. Copies can be obtained by addressing Dept. M of the company on a regular business letter-head.

Thread-Cutting Machines and Tools

LANDIS MACHINE CO., INC., Waynesboro, Pa., is distributing a unique piece of advertising literature known as the Landis "Check Book." The information is given in the form of a regular check book, on the outside of which are the words, "Bank on Landis for Savings." Each sheet of the book contains cost and production figures on actual threading jobs performed by users of Landis machines under normal operating conditions. The jobs illustrated were selected with a view to covering as many different types of threading and tapping jobs as possible. Users of thread-cutting and tapping equipment should find this book of considerable value in checking costs and production records.

Wrenches

J. H. WILLIAMS & CO., 75 Spring St., New York City. Booklet A-409, illustrating and describing the Williams line of "Supersocket" (detachable socket) wrenches; "Superrenches," of chrome-molybdenum; the "Superector," a new heavy-duty reversible ratchet wrench; "nonsparking" safety wrenches; and two new lines of adjustable wrenches. Booklet A-81, describing the complete line of drop-forged carbon steel wrenches made by this concern, which includes fifty patterns and more than one thousand sizes. "Bull Dog" types and screw wrenches are also included.

Rustproof Sheet Metal

REPUBLIC STEEL CORPORATION, Cleveland, Ohio. Booklet entitled "The Path to Sheet Metal Permanence," containing more than sixty photographs depicting many uses for sheet metal in a wide variety of applications. Information on the rust resistance, forming, and welding properties of Toncan copper-molybdenum iron, as well as data on physical properties and constants, forms, finishes, sizes, and gages, is included.

Small Tools

BROWN & SHARPE MFG. CO., Providence, R. I. Circular entitled "Protect Quality and Quantity with Good Tools," showing a variety of examples of Brown & Sharpe tools, including micrometers, rules, squares, plug and ring gages, depth gages, screw pitch gages, etc. The circular also shows the air-conditioned measuring room and testing equipment by means of which the accuracy of these tools is insured.

Ball Bearings

NICE BALL BEARING CO., 30th and Nicetown Lane, Nicetown, Philadelphia, Pa. Catalogue 102, containing data on the various types of ball bearings made by this concern. The material covers balls, ball retainers, thrust ball bearings, radial ball bearings, combination type ball bearings, sheaves, wheels, and casters. Catalogue 100, containing information on "Red Diamond" ball-bearing casters.

Grinding Wheels

NORTON CO., Worcester, Mass. Booklet containing information on the grinding of cemented-carbide tools, including recommended grinding procedure; wheels for various tools and grinding operations; lapping; Norton diamond wheels and how to use them; the field for Norton diamond wheels; and sizes and shapes of Norton diamond wheels.

Portable Pneumatic and Electric Tools

ROTOR AIR TOOL CO., Cleveland, Ohio. Catalogue 15, containing data on Rotor portable air tools, including drills, reamers, screwdrivers, grinders, buffers, sanders, and wire-brushing tools. Catalogue entitled "The Facts About High Cycle Electric Tools," giving engineering, production, and operating information on the Rotor line of electric tools.

Grinding Machines

LANDIS TOOL CO., Waynesboro, Pa. Catalogue K-37, illustrating and describing the features of construction of the Landis 12- by 28-inch universal and tool grinder. The illustrations show typical set-ups for different classes of work. Complete specifications are included.

Lubricating Systems

BIJUR LUBRICATING CORPORATION, Long Island City, N. Y. Bulletin D on Bijur automatic forced-feed centralized lubricating systems. Besides the illustrated descriptions of the equipment, many examples of applications on a variety of machines are shown.

Corrosion of Cast Iron

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York City. Publication entitled "Some Consequences of Graphitic Corrosion of Cast Iron," dealing with the type of corrosion that results in the formation of a surface layer of residual graphite, and methods of reducing it.

Feed-Fingers for Automatic Machines

EASTERN MACHINE SCREW CORPORATION, 23-43 Barclay St., New Haven, Conn. Circular containing data, including price lists, on H & G Type K feed-fingers and adapters for use on various types of automatic screw machines.

Wire and Cable

ANACONDA WIRE & CABLE CO., 25 Broadway, New York City. Publication C-35, entitled "Industrial Guide for the Selection of Wire and Cable," giving information intended to aid engineers in the selection and application of wire and cable.

Electric Motors

FAIRBANKS, MORSE & CO., 900 S. Wabash Ave., Chicago, Ill. Bulletin 1600, describing this company's line of polyphase wound-rotor or slip-ring ball-bearing induction motors, designed to operate at either constant or regulated varying speeds.

Materials-Handling Equipment

CLEVELAND CRANE & ENGINEERING CO., Wickliffe, Ohio. Circular G-237, entitled "How to Plan a Materials-Handling System," describing the floor type and overhead type of equipment and illustrating applications on various classes of work.

Roll-Thread Snap Gages

PRATT & WHITNEY DIVISION OF NILES-BEMENT-POND CO., Hartford, Conn. Circular 428, covering Pratt & Whitney John-Sons roll-thread snap gages, "Tri-roll" gages, and a new combination of taper plain and thread plug and ring gages.

Heat-Treating Furnaces and Automatic Controls

LEEDS & NORTHRUP CO., 4921 Stenton Ave., Philadelphia, Pa. Circular describing the application of the Rayotube-Micromax electric control on high-temperature heat-treating furnaces.

Electric Hoists

SHEPARD NILES CRANE & HOIST CORPORATION, 444 Schuyler Ave., Montour Falls, N. Y. Bulletin 126, illustrating and briefly describing the design and construction of Shepard Niles anti-friction bearing hoists known as "Lift Abouts."

Blowers and Compressors

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis. Bulletin 1910, illustrating and briefly describing the various types of blowers and compressors made by the company, which include centrifugal, rotary, and reciprocating units.

Recording and Controlling Equipment

BROWN INSTRUMENT CO., Wayne and Roberts Aves., Philadelphia, Pa. Catalogue 15C, covering the complete line of Brown millivoltmeter pyrometers of the indicating, recording, and controlling types.

Boring Tools

GIERN & ANHOLTT TOOL CO., 1312 Mount Elliott Ave., Detroit, Mich. Loose-leaf circular containing data on boring equipment, including precision rotary jig and pilot bushings, boring blocks, boring-bars, and boring tools.

Pipe Cutting and Threading Machines

CURTIS & CURTIS CO., 324 Garden St., Bridgeport, Conn. Circular descriptive of the new Curtis pipe cutting and threading machine, made in hand, belt, and electric types.

Industrial Furnaces and Pumps

W. S. ROCKWELL CO., 50 Church St., New York City. Leaflet 366, descriptive of Rockwell direct-connected, motor-driven, fuel oil pumps. Bulletin 368, illustrating and describing Rockwell oil or gas fuel pot furnaces.

Welding Equipment

LINCOLN ELECTRIC CO., Cleveland, Ohio. Catalogue entitled "Building a Career in Arc Welding," describing the Lincoln welding school and advanced welding courses offered by this concern.

Tool and Cutter Grinders

OLIVER INSTRUMENT CO., 1410 E. Maumee St., Adrian, Mich. Circular describing the Oliver universal tool and cutter grinder and illustrating various set-ups for grinding different types of cutters and reamers.

Woven Wire Products

NEWARK WIRE CLOTH CO., Newark, N. J. Folder illustrating and describing the "End-Shak" testing sieve shaker. Information is also given on Newark testing sieves, which conform to U. S. and A.S.T.M. standards.

Diamond Tools

KOEBEL DIAMOND TOOL CO., 1208 Oakman Blvd., Detroit, Mich. Circular entitled "How Much Work Should a Diamond Do?" showing three different types of Koebel diamond tools for wheel-dressing.

Steam-Driven Compressors

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Bulletin L-612-B3, containing detailed information on Worthington opposed steam-driven heavy-duty compressors.

Motor-Driven Welders

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Bulletin 26-120, containing specifications and detailed information on Flexarc motor-driven welders and bare generators.

Self-Oiling Pumps

FAIRBANKS, MORSE & CO., 900 S. Wabash Ave., Chicago, Ill. Bulletin 6165, descriptive of this company's line of duplex self-oiling power pumps for use under severe conditions.

Metal Spraying Equipment

METALSPRAY CO., 113 Llewellyn St., Los Angeles, Calif. Bulletin 700,

describing the new Universal Metal-spray gun applicable for either hand or machine spraying.

Hydraulic Welding Equipment

PROGRESSIVE WELDER CO., 737 Piquette, Detroit, Mich. Catalogue covering the line of hydraulically driven welding guns and equipment made by this concern.

Electric Furnaces

AJAX ELECTROTHERMIC CORPORATION, Trenton, N. J. Bulletin 11, describing Ajax-Northrup electric furnaces for melting ferrous and non-ferrous metals.

Lubricants

FISKE BROS. REFINING CO., 24 State St., New York City. Circular entitled "The Lubriplate Film," describing the advantages of Lubriplate lubricants.

Pyrometers

C. J. TAGLIABUE MFG. CO., Park and Nostrand Aves., Brooklyn, N. Y. Catalogue 1101C, descriptive of the "Tag" line of high-speed photo-electric pyrometers.

Tempering Furnaces

LEEDS & NORTHRUP CO., 4921 Stenton Ave.. Philadelphia, Pa. Circular descriptive of a new small size Homo tempering furnace for use in tool drawing.

Speed Indicators

HASLER-TEL CO., 461 Eighth Ave., New York City. Circular entitled "Speed Affects Your Earning Power," descriptive of the Hasler speed indicator.

Electric Heating Devices

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletin GED-650, listing numerous small heating units intended for a variety of work.

Electric Equipment

RELIANCE ELECTRIC & ENGINEERING CO., Ivanhoe Road, Cleveland, Ohio. Bulletin 501, descriptive of Reliance motor-generator sets.

Brazing Alloys

HANDY & HARMAN, 82 Fulton St., New York City. Bulletin 10, descriptive of "Easy-Flo," a brazing alloy with a low melting point.

Electrode-Holders

LINCOLN ELECTRIC CO., Cleveland, Ohio. Specification Bulletin 321, illustrating and describing the Lincoln Type T electrode-holder.

Electric Control Equipment

ALLEN-BRADLEY CO., 1326 S. Second St., Milwaukee, Wis. Circular covering the Bulletin 709 automatic solenoid starter.

Laboratory Equipment

BAUSCH & LOMB OPTICAL CO., Rochester, N. Y. Circular descriptive of Bausch & Lomb polaroid micro accessories.

Westinghouse Machine Tool Electrification Forum

More than sixty representatives of the leading machine tool manufacturers attended the second Machine Tool Electrification Forum sponsored by the Westinghouse Electric & Mfg. Co. at East Pittsburgh, Pa., April 19 to 22. The object of the forum is to solve the mutual problems of the machine tool manufacturers and electrical engineers with reference to machine tool electrification. The slogan of the meeting was well expressed in the program by the words "Progress Inevitably Results from a Free Exchange of Knowledge."

Nearly a score of papers were presented dealing with almost every phase of machine tool electrification, including many new developments, such as the dynamic braking of alternating-current motors, wide speed range of direct-current drives, adjustable-speed alternating-current motors, electric welding, and new methods of dynamic balancing. These papers were presented by representatives of the machine tool industry, as well as by Westinghouse works, design, and application engineers. The last day of the meeting was devoted to discussions of the specific problems submitted by the visiting machine tool engineers in conference with representatives of the Westinghouse company.

* * *

The Leipzig Spring Fair gave definite indications of improved business conditions throughout the world. The attendance at the Fair was greater than at any previous time, reaching 278,000 people from seventy-four countries. In total, there were 8897 exhibits, a 10 per cent gain over 1936. Foreign exhibitors and buyers numbered over 33,000.

This Modern Covered Wagon is a Portable X-ray Unit Mounted on a Trailer Chassis, which is Employed by the St. John X-Ray Service, Inc., Long Island City, N. Y., for Industrial X-ray Inspections where the X-ray Equipment must be Brought to the Work. The Equipment is Powerful enough to Penetrate 3 Inches of Steel in a One-minute Exposure

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Bardons & Oliver Electric Turret Lathe

Speed changes, reversal of the spindle, instantaneous application and release of the brake, actuation of the bar feed, and operation of the automatic chuck are all effected electrically in a turret lathe recently developed by Bardons & Oliver, Inc., Cleveland, Ohio. While this completely electrically controlled turret lathe was designed primarily for brass work, it is also applicable to other work that can be machined at high speed. Spindle speeds of 600, 1200, 1800, and 3600 revolutions per minute are available.

The headstock of this machine encloses a four-speed reversing motor, the rotor being mounted on the spindle and the stator in the housing. The four spindle speeds are obtained through a single lever mounted on the front of the head, as seen in Fig. 1. Starting, stopping, and reversing are effected through a second lever, mounted on the same center as the first, the second lever being used to operate a magnetic reversing controller.

The brake is operated through a solenoid switch, which is actuated by imparting a gentle inward pressure on the forward and reverse lever when it is in the neutral position. The lined brake band is located in the head end bracket, where it is readily accessible for adjustment. Braking pressure is applied on a large-diameter drum, keyed to the rear end of the spindle.

Electric chucking and feeding of the bar stock has been provided for, so as to save labor and increase the output. However, a hand-operated arrangement can be provided, as illustrated in Fig. 2, when work is to be handled in small or medium quantities. With the electrical arrangement, which is seen on the machine in Fig. 1, the cycle on simple high-speed work is controlled by a trigger mechanism that operates in connection with the cross-slide feed-lever. Movement of this lever in one direction actuates the cutting-off operation, while the return movement operates the trigger mechanism. For work requiring complicated tooling, the trigger mechanism can be operated manually by means of a small lever on the front of the bracket that is attached to the headstock.

The automatic chuck wedge and the bar feeding head are actuated by a motor-driven compound cam-drum. When the trigger mechanism is tripped, the cam-drum makes one complete revolution and then stops, the collet opens, the bar is fed forward a predetermined length, the collet again grips the bar, and the bar feeding head recedes. The time required for the entire cycle is only 1 1/2 seconds.

Setting up and adjusting for a new job are facilitated by means of an auxiliary automatic chuck lever mounted on the head-end bracket and an auxiliary feeding handle mounted at the end of the T-slotted bar. The length of the bar feed stroke is adjusted by moving the inner end of the bar feed link up or down in the T-slotted bar.

Work up to 5/8 inch in diame-

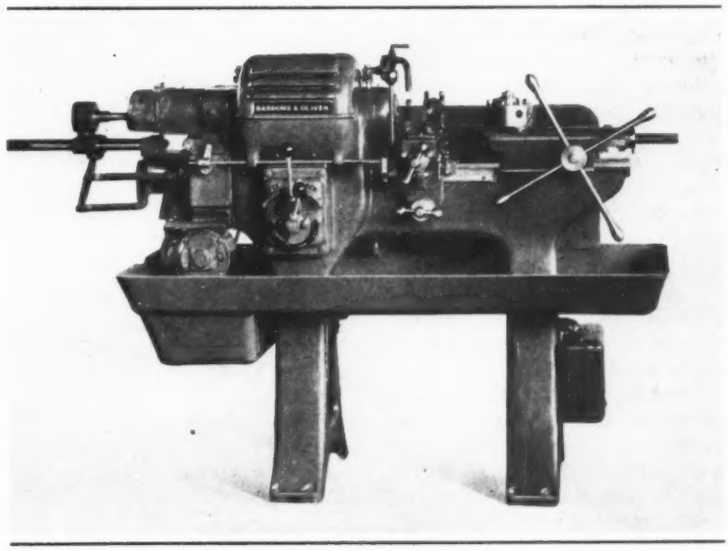


Fig. 1. Bardons & Oliver Turret Lathe with Complete Electrical Control

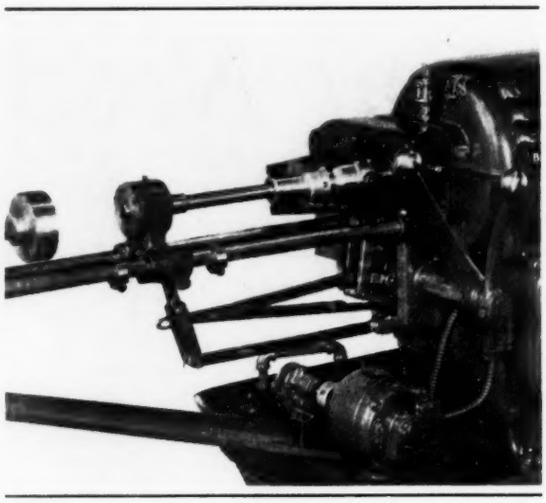


Fig. 2. A Hand-operated Automatic Chuck and Bar Feed are Available for Small- or Medium-quantity Work

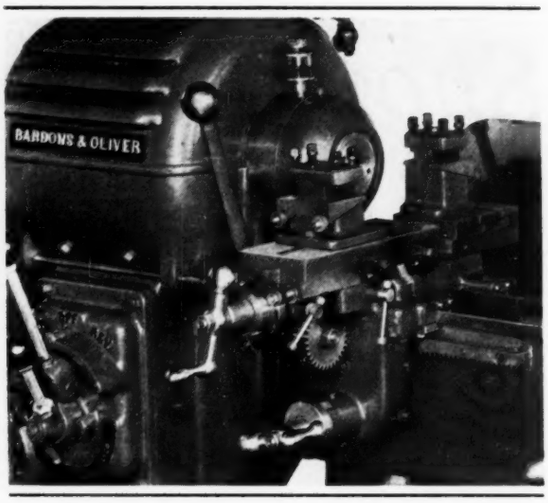


Fig. 3. The Cross-slide and Carriage are Equipped for Easy Duplication of Work Diameters and Shoulder Lengths

ter can be handled through the use of an inside feed-finger, mounted on a long tube directly in back of the collet, while work from 5/8 to 7/8 inch in diameter can be handled by means of an outside feed-finger, mounted in the sliding bar feed head.

With the hand-operated automatic chuck and bar feed, opening and closing of the collet and feeding of the bar are accomplished by means of a lever on the front of the head-end bracket, as seen in Fig. 2. The feed-finger is returned by means of a short lever that operates on the same center. The feeding stroke of the bar is controlled through adjustable collars.

One of the features of design of the turret-slide and saddle is the use of an adjustable preloaded tapered roller bearing of large diameter, which eliminates the customary turret-binder lever. This construction is illustrated in Fig. 4. The vertical lock-bolt is operated and the turret indexed by the backward movement of the slide. This movement also causes the six longitudinal stops to index in synchronism with the turret. Both the turret-slide and the saddle are provided with wear strips of hardened alloy steel. Either a lever or a turnstile can be furnished for the turret-slide.

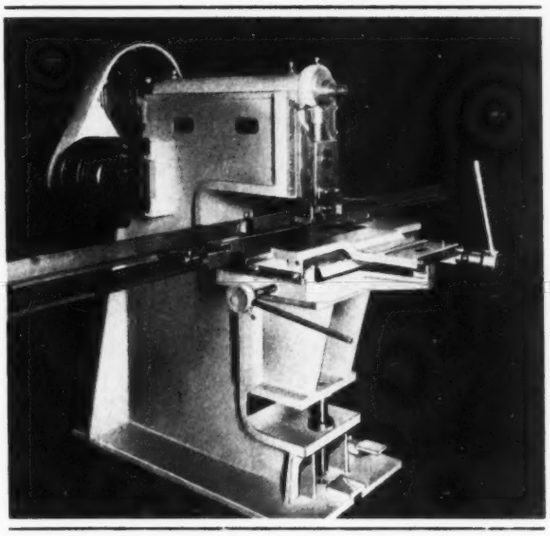
Accurate duplication of diameters on work is facilitated by means of latch type cross-slide stops, which are mounted on the feed-screw in front of a large graduated dial. The stops are supplemented by stop-blocks on the side of the cross-slide, as seen in Fig. 3, which are equipped with adjusting screws. Easy duplication of shoulder lengths and accurate longitudinal settings of the cross-slide are obtainable through a graduated dial. A combination lever and screw feed is furnished for the cross-slide. The double front and rear toolposts are equipped with adjustable wedges for height adjustment of the cutters.

The swing over the bed of this machine is 11 3/8 inches; over the carriage guides, 10 1/4 inches; and over the cross-slide, 4 5/8 inches. The total cross travel of the cross-slide is 5 inches, and the longitudinal travel of the carriage, 10 inches.

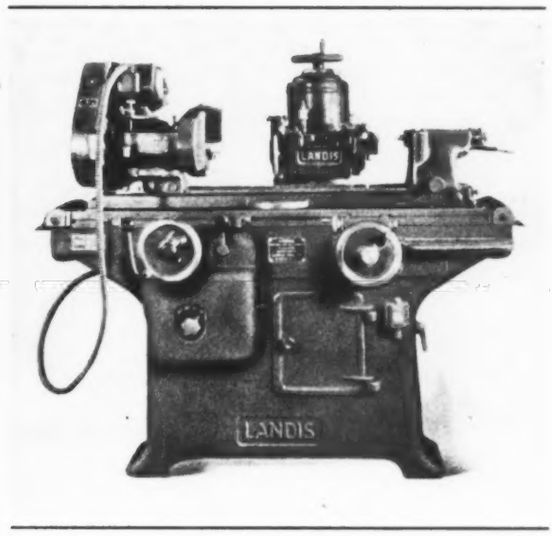
Fig. 4. A Tapered Roller Bearing Mounting for the Turret Eliminates the Binder Handle

Colmonoy Overlay Paste

A paste material and a new process for producing a welded-on wear-, heat-, and corrosion-resistant overlay or hard facing on metals are being announced by Colmonoy Inc., Los Nietos, Calif. The paste is contained in collapsible tin tubes. It may be conveniently spread over the surface to be processed, and then sweated into the parent metal with the flame of an oxy-acetylene torch, atomic-hydrogen torch, electric arc, or furnace heat. This forms an overlay that becomes a part of the metal processed. It is claimed that the overlay does not chip off and that it does not interfere with hot or cold forging, forming, or heat-treatment of the parent metal.



All-steel Adjustable-bed Press of Light-weight Deep-throat Construction



Grinder Adapted for Surface, Internal, and Cylindrical Grinding and for Resharpening Cutters

Service All-Steel Deep-Throat Presses

The Service Machine Co., 750-760 Broadway, Elizabeth, N. J., has brought out a light-weight series of deep-throat adjustable-bed power presses which are constructed with all-steel welded frames and welded adjustable-knee beds. When equipped with a nibbling attachment as illustrated, these presses are furnished with a small light-weight flywheel, together with a high-speed clutch and oil-ring bearings. This construction permits operating speeds up to 175 strokes a minute, enabling blanks of irregular contour to be cut out rapidly. A larger diameter flywheel is provided when a somewhat lower speed and greater stored energy are required for heavier work.

The nibbling attachment can be quickly removed to make the machine adaptable for punch and die work. The eccentrics can also be readily changed to provide different lengths of stroke. The clutch has a safety non-repeat device intended for use with standard dies. This safety device can be disengaged by turning a button, and the treadle locked down, when a nibbling attachment is to be used on the machine.

Landis Universal and Tool Grinder

Surface and internal grinding operations, in addition to the usual external cylindrical grinding, can be performed with the standard equipment of a 12- by 28-inch universal and tool grinder recently developed by the Landis Tool Co., Waynesboro, Pa. Gear-cutters, milling cutters, reamers, taps, and similar tools can also be resharpened with the standard equipment. Attachments can be supplied for grinding hobs, circular forming tools, large saws, and staggered-tooth gear-cutters, as well as for performing special operations of a tool-room character. A water reservoir cast integral with the machine bed makes it a simple matter to apply a wet grinding attachment at any time.

The wheel-head can be swiveled 90 degrees in either direction. It can also be raised or lowered and fed toward or away from the work. The headstock can be swiveled as much as 90 degrees for face grinding, and it can be used for either dead- or live-spindle work. There is a power work-table traverse of four different speeds, a power work-spindle rotation, and a two-speed hand-traversing mechanism. The regular cross-feed handwheel is supplemented by a fine cross-feed handwheel. A lever can be attached at the rear of the machine to effect table traverse from that location, and a cross-feed handwheel can also be provided at the rear.

The wheel-head is driven by a motor mounted on the rear, from which power is transmitted to the wheel-spindle through a V-belt. Belt changes can be readily accomplished, and the motor position can be easily adjusted to maintain the proper belt tension. The entire wheel-spindle housing can be easily removed in order to apply the special surface-grinding head that is available. The handwheel at the top of the wheel-head is used to change its vertical position, this handwheel being provided with a collar that is graduated in thousandths of an inch to facilitate accurate settings.

The headstock is driven by a constant-speed motor. Three work-spindle speeds are obtainable by shifting a single V-belt at the left-hand end of the head, and this number of speeds can be doubled by changing a pulley at the right-hand end of the jack-shaft. The traverse drive is self-contained in a gear-box. Changing of traverse speeds is effected through a knob at the front of

the bed. When it is desired to traverse the table by hand, the power drive can be disengaged.

The traverse unit is so arranged that, by the operation of one lever, the work rotation can be started without the table traverse being actuated; both the work rotation and the table traverse can be started; or the table traverse can be started without the work being rotated. All electrical control equipment is contained in a compartment at the right-hand end of the bed, which is accessible by merely opening a door.

Work up to 200 pounds in weight can be carried on the centers of this machine; the maximum diameter that can be ground with a full-size wheel is 12 inches. The maximum distance between centers with the universal headstock is 28 inches, and with the left-hand footstock 33 3/4 inches. The swing over the table with the water guards removed is 12 1/2 inches, and the swing over the table water channel with the headstock swiveled for face grinding, 25 inches.

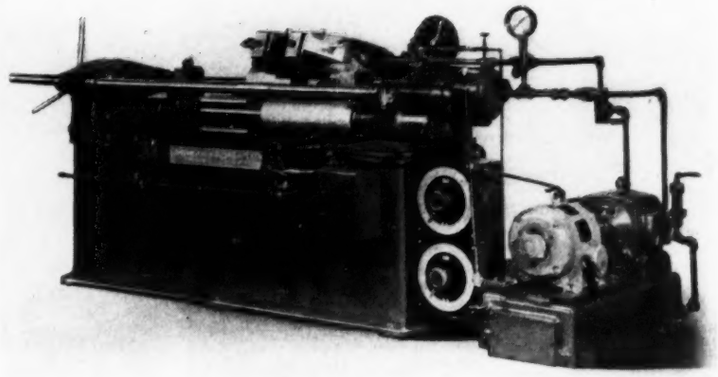


Fig. 1. Thomson-Gibb Flash Welder Designed for Accuracy in Such Operations as Welding Drill Shanks to Cutting Ends

Thomson-Gibb Flash Welders

A precision that is unusual for a flash welding machine is claimed for the Model F 29 welder, illustrated in Fig. 1, which has recently been developed by the Thomson-Gibb Electric Welding Co., Lynn, Mass. All parts under stress are designed to prevent deflection to any degree that might interfere with obtaining the close accuracy essential in welding drills, reamers, and other tools.

The work back-up stops are mounted directly on top of the frame, and are so arranged that they cannot be lifted or deflected in any direction. The work-stops and tie-rods that strengthen the frame are on a common line with the center of the welding pressure, another feature that minimizes deflection.

This machine is rated at 300 kilovolt-amperes. It has a capacity for welding carbon-steel drill shanks up to 3 1/8 inches in diameter to high-speed steel cutting ends, or other solid pieces having a maximum area of 7.7 square inches. Tubular sections are limited to outside diameters of 4 5/8 inches and to an area of 8 square inches. Stock 18 inches long can be handled in the right-hand end of the machine, and 38 inches long in the left-hand end. Pressure is applied hydraulically.

Another recent development of the same concern is the flash-proof flue-welder illustrated in Fig. 2, which is primarily intended for railway applications. The transformer of this equipment is offset in the frame to provide a direct path for the flash dirt to drop to the floor without striking the transformer core or coils. The slide bearings are set out at the ends well away from the line of the flash, while the piston-rods and linkage which operate the air clamps are shielded by a hood.

Push-up pressure is supplied by a hydraulic cylinder. For convenience and to provide an accurate control of the platen, the hydraulic pilot valve is regulated through an unusually long lever.

Dies for small flues are so arranged that two different sizes can be handled by one set of blocks. Separate sets of dies are required for flues larger than 4 inches in diameter. The dies are adjustable for vertical alignment by means of handwheels at the front of the machine. Accurate heat control is provided through ten points of regulation.

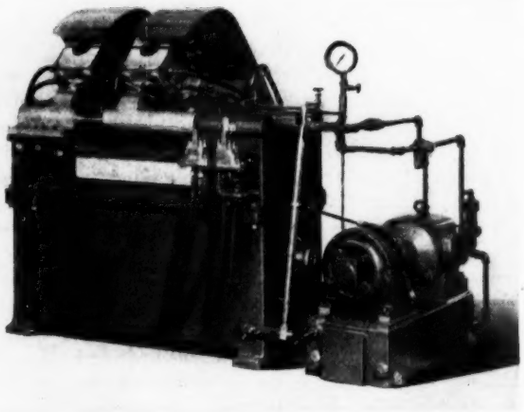
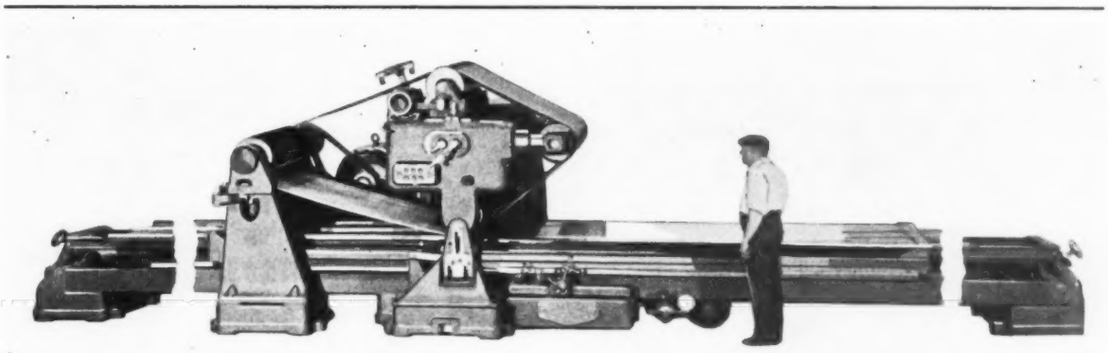


Fig. 2. Thomson-Gibb Welder Developed for Railway Flue-welding Shops



Mattison Abrasive-belt Polishing Machine which will Accommodate Sheets up to 48 Inches Wide by 14 Feet Long

Mattison Wide-Belt Sheet Grinder

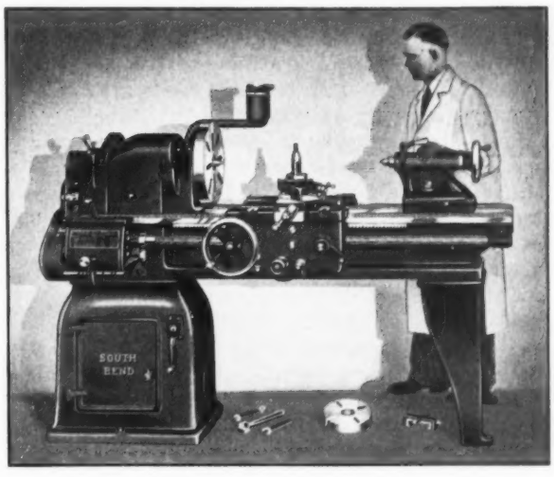
Sheets of stainless steel and other alloys up to 48 inches in width by 14 feet in length can be polished on a machine recently built by the Mattison Machine Works, Rockford, Ill. This equipment employs factory-coated abrasive belts 50 inches wide. The machine is built with the necessary weight and accuracy to insure smooth surfaces.

A push-button station and table controls are located on the front of the machine. Contact rolls with any desired degree of cushioning can be easily interchanged to suit the nature of the work. Wide-belt grinders of this type can also be built in different widths and to various lengths to suit requirements of individual manufacturers.

South Bend Underneath-Belted Motor-Driven Lathe

Back-geared screw-cutting lathes with a new underneath-belted motor drive have been brought out by the South Bend Lathe Works, 773 E. Madison St., South Bend, Ind., in a series that includes machines having swings of 9, 11, 13, 15, and 16 inches. The bed lengths range from 3 to 12 feet.

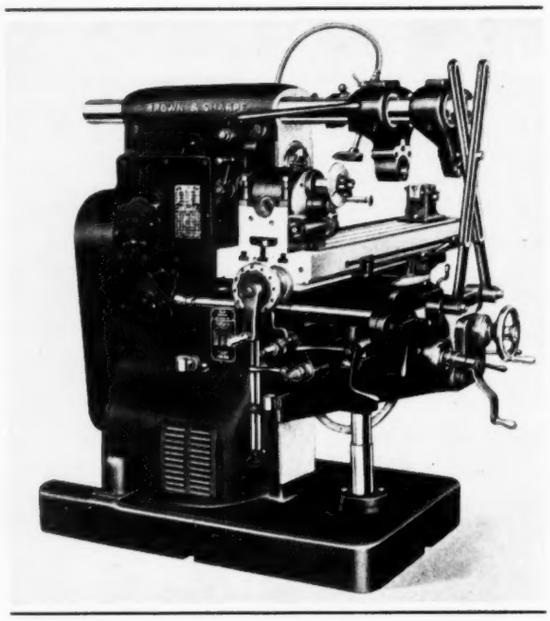
The new drive is designed for compactness, silence, and economical operation. The motor and driving mechanism are fully enclosed in the cabinet leg, there being no overhead belts or pulleys to obstruct the view or cast shadows on the work. Power is transmitted from the motor to a countershaft through a V-belt, and from the countershaft up through the lathe bed to the headstock cone pulley by a flat leather belt. Any desired tension can be obtained on both the motor and cone-pulley belts through adjustments. A belt-tension release lever on the front of the cabinet leg permits easy shifting of the cone-pulley belt.



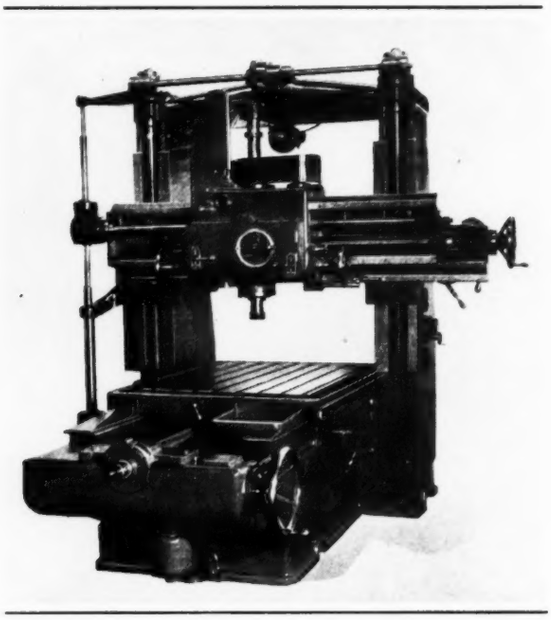
South Bend Lathe with Underneath Belted Motor Drive and Quick-change Gears

With this driving arrangement, the pull on the spindle is down against the solid portion of the headstock. Starting, stopping, and reversing of the lathe spindle are effected from a switch on the front of the lathe. All bearing surfaces of the heat-treated spindle, including the tapered hole, are ground. The spindle bearings are line-bored and lapped, and are adjustable for wear. Attachments can be provided for milling, keyway-cutting, grinding, taper-turning, gear-cutting, and draw-in collet work, thus adapting the lathes for use in toolrooms, general machine shops, and manufacturing plants.

These lathes are built in both quick change-gear and standard change-gear types. The quick change-gear type is adapted for cutting forty-eight right- and left-hand standard screw threads ranging from 2 to 112 per inch, and including 11 1/2 per inch pipe threads, while the standard change-gear lathes are adapted for cutting from 2 to 40 threads per inch.



Brown & Sharpe Universal Milling Machine with Complete Control at Both Front and Rear



Precision Jig Boring Machine Recently Built by the Cleveland Universal Jig Co.

Brown & Sharpe Standard and Dual-Control Milling Machines

Eight plain and universal milling machines of new design, in the Nos. 2 and 3 sizes, are being placed on the market by the Brown & Sharpe Mfg. Co., Providence, R. I. These machines retain features of the Standard and High-Speed models which they replace, and in addition, embody improvements that meet present-day milling requirements and facilitate operation.

The new machines are available in two styles, a Standard type which is intended for the straight-forward run of manufacturing or tool-room work, and a Dual Control type for work requiring a wide feed range and complete control of the machine from both the front and rear. The illustration shows a No. 2A universal machine of the latter type. Sixteen spindle speeds ranging from 30 to 1200 revolutions per minute are available.

All machines of the new line can be provided with either an overhead drive or a motor drive in the base. Other features common to all machines include a fast travel of 140 inches per minute longitudinally and 56 inches per minute transversely and vertically; a safety hand-crank for the longitudinal table adjustments; automatic lubrication of the knee and column mechanisms; and rotating selective feed and speed levers. Furthermore, all machines have a two-position control of the feed engagement, direction of all feeds, and starting and stopping.

On Dual Control machines, all fast travel and hand movements can be controlled from the front and rear operating positions. Thirty-two rates of feed are available on machines of this style, ranging from 9/32 inch to 40 1/4 inches per minute longitudinally and from 1/8 inch to 16 1/8 inches per minute transversely and vertically.

Sixteen rates of feed are regularly available on Standard machines, the longitudinal feeds ranging from 11/16 inch to 26 inches per minute, and the transverse and vertical feeds from 9/32 inch to 10 3/8 inches per minute. However, a wide-feed range mechanism can be supplied as extra equipment on this type of machine.

Cleveland Precision Jig Boring Machine

The precision jig boring machine here illustrated has recently been built by the Cleveland Universal Jig Co., 13,404 St. Clair Ave., Cleveland, Ohio. The table of this machine has a working surface of 40 by 60 inches, and is provided with eight T-slots and one aligning slot in the center. The table longitudinal screw is fitted with a 6-inch dial graduated in thousandths of an inch, and to facilitate closer settings, this dial is fitted with a vernier. Settings made with the dial and vernier are, of course, controlled by the accuracy of the screw. To provide further accuracy, there has been provided a vernier slide which runs the entire length of the table. The table screw is driven by a 1/2-horsepower motor.

The cross-rail screw provided for traversing the spindle saddle is also equipped with a micrometer dial fitted with a vernier, and there is a vernier slide to facilitate correct cross-rail settings. The cross-rail is raised and lowered by a 3/4-horsepower motor. The spindle saddle is fed

across the rail by a 1/2-horsepower motor. Push-button controls are supplied for all these motors, which were built by the General Electric Co. There are also handwheel controls for the table, saddle, and spindle movements.

The spindle is driven through a 7 1/2-horsepower New Departure Transitorq motor, which provides variable speeds. The drive from this motor is through a shaft at the side of the left-hand housing, thence to the cross-rail shaft and to a vertical shaft on the spindle housing. Power for high speeds is transmitted from this vertical shaft to the spindle through four V-belts, thus preventing vibration from being transmitted to the spindle. Slow speeds are obtained through worm-gears. The spindle runs in precision ball bearings.

This jig boring machine occupies a floor space of 9 by 11 feet, and weighs approximately eight tons.

Toledo Repunching Press

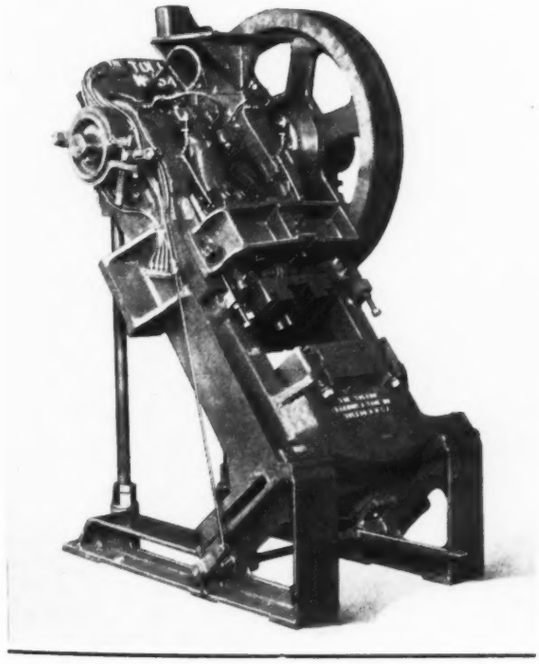
In the quantity production of field and rotor laminations for motors, it is common practice to cut the blanks from full-size steel sheets in a large automatic press, so as to obtain maximum economy of material. The blanks are then repunched in compound dies, set up in presses that must be especially rigid and accurate. For this class of service, the Toledo Machine & Tool Division of the E. W. Bliss Co., 1420 Hastings St., Toledo, Ohio, has brought out a new design of the No. 54 straight-sided single-crank press built by the concern. This press is of the flywheel type. It has a direct-connected motor drive through a silent pinion which meshes with teeth on the flywheel. A three-horsepower motor running at 820 revolutions per minute drives the press.

The frame is of one-piece construction and is cast of chrome-nickel semi-steel. The press has a stroke of 2 1/2 inches, and the maximum distance from the bed to the slide is 13 inches. The shaft can be operated at speeds to provide from 65 to 90 strokes a minute. Fixed legs hold the press at an angle of 40 degrees.

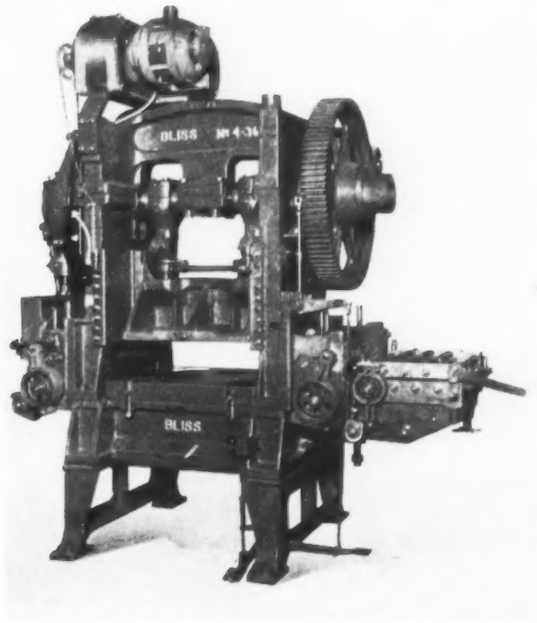
The bolster is provided with T-slots and poppets for the inclined setting of dies. The slide has a face measuring 14 inches square. It actuates a cam stripping device which is adjustable to permit the stripping of work at any point in the stroke.

Bliss Automatic Double-Crank Press

An improved design of the No. 4 high-speed automatic blanking press built by the E. W. Bliss Co. has recently been produced at the Toledo plant of the concern. Although single-geared, this press will operate at from 30 to 90 strokes a minute through a variable-speed drive. This range of speed permits the



Toledo Press Designed Specifically for Repunching Field and Rotor Laminations



Bliss Improved Automatic Double-crank Press which Handles Coil Stock up to 24 Inches Wide

selection of the best operating conditions to suit the desired length of feed and the thickness of the metal that is to be worked. Adjustment of the variable-speed drive is controlled through a hand chain.

Power is transmitted from the five-horsepower driving motor to the flywheel by means of V-belts. A high-speed rolling-key clutch, locking pawl, and releasing brake are standard equipment. The stroke is 1 1/2 inches, and there is a slide adjustment of 3 inches. The shut height from the bed to the slide, with the stroke down and the adjustment up, is 11 1/2 inches. The slide area is 28 by 31 inches, and the bed area 34 by 35 1/2 inches.

A high-speed double-roll feed, including a seven-roll driven straightener and a shear type scrap cutter, is mounted on the press. Coil stock 24 inches wide can be fed from right to left through openings in the press housings. This machine was originally developed for use in rolling mills to cut large circular or irregular shaped blanks for the trade, thus effecting a saving through the elimination of the shipment of a large amount of material that would eventually become scrap.

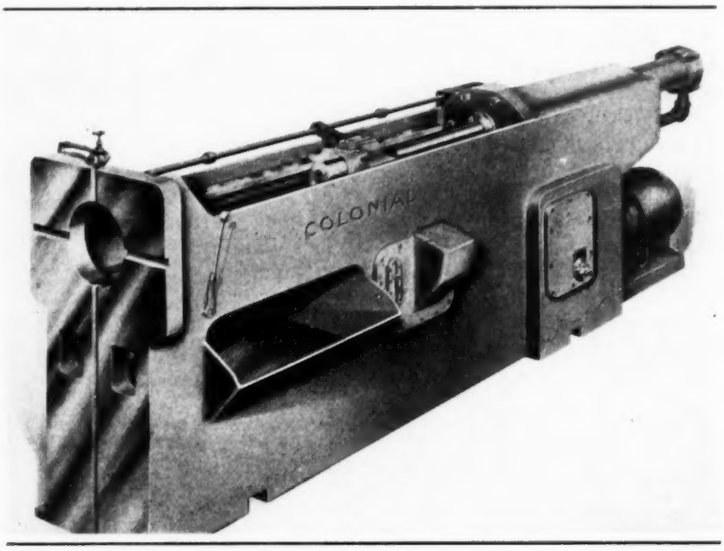


Fig. 1. Colonial Broaching Machine Designed for Ready Adaptability to Any Type of Broaching Operation

Colonial Universal Broaching Machine

A horizontal machine adapted for almost every type of broaching operation is the latest development of the Colonial Broach Co., Detroit, Mich. The machine is as readily adapted for surface broaching as for the broaching of round or splined holes, helical or straight keyways, etc. In addition to this unusual flexibility, other features of the machine include automatic operation and high production speeds.

This broaching machine is of the pull type and is hydraulically operated. It is available in two basic-stroke designations, 48 and 60 inches, and is built in capacities of 6, 10, 15, and 20 tons. Stop-collars can be used to provide any length stroke in accordance with the work to be performed and the broach to be used. The standard cutting speed is 30 feet a minute, but any speed up to this rate can be obtained. Return speeds of either 60 or 100 feet a minute are available. The machine can be operated either from the right-hand or left-hand side through the provision of dual controls.

The unusually large faceplate with its two keyways that facilitate accurate location of fixtures is especially advantageous for surface broaching operations. Tools 9 inches in width and even slightly larger can be used. Follow-rests can be provided for broaches of extra large size.

A spiral drive attachment has been developed for use in broaching internal helical splines, as illustrated in Fig. 2. This device consists of a rigidly mounted spiral master bar, which, through gears, causes the broach to rotate as it passes through the work, thus producing the correct helical lead in the part.

In the range of broach-pullers available, are included automatic pullers designed for maximum accuracy

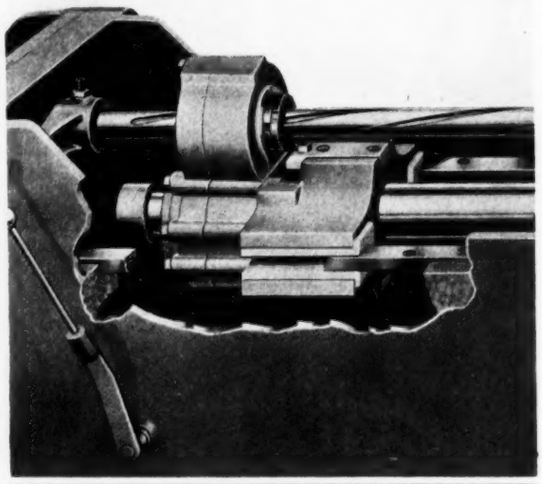


Fig. 2. A Spiral Drive Attachment which Causes the Broach to Revolve in Cutting Internal Helical Splines

as to alignment and broach locating; threaded pullers for broaching keyways; and key type pullers for use when maximum simplicity and low cost are desired. Locating markers on the cross-head and pull-head simplify puller adjustment.

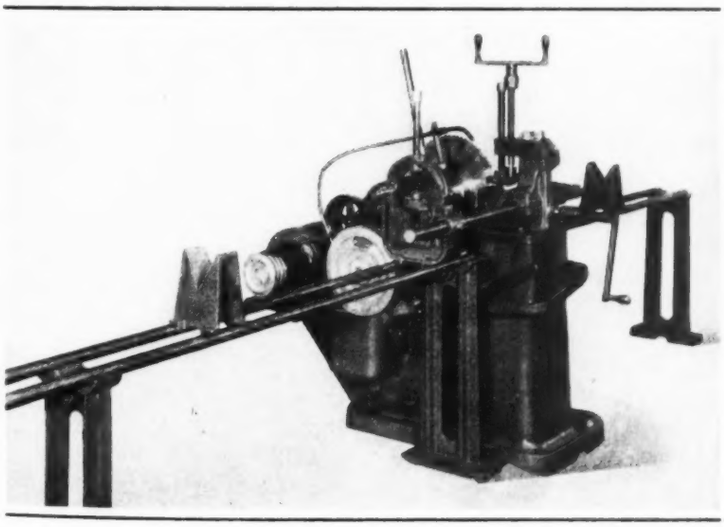
The standard equipment includes a chip trough which extends the entire length of the machine. All coolant and chips drain from this trough into a pan provided with perforated trays that permit the coolant to drain back into the sump. Chips can be removed from either side of the machine. The base of this universal broaching machine is constructed of fabricated steel.

Cochrane-Bly Saw for Cutting Small Bars in Multiple

A circular-saw machine arranged with a support track and stock feed for cutting small bars in multiple, as here illustrated, is a recent development of the Cochrane - Bly Co., 15-21 St. James St., Rochester, N. Y. Eight round bars 1 1/8 inches in diameter can be held in the vise at one time, or 118 bars 1/4 inch in diameter. Other sizes can be held in proportionate numbers. A cut takes 1 1/2 minutes.

If desired, the machine can be furnished with a three-screw vise for holding the pieces being cut off outside of the saw blade and insuring clean cuts without prongs. The machine can also be arranged for cutting single bars, and there are three changes of feed to suit hard and soft stock.

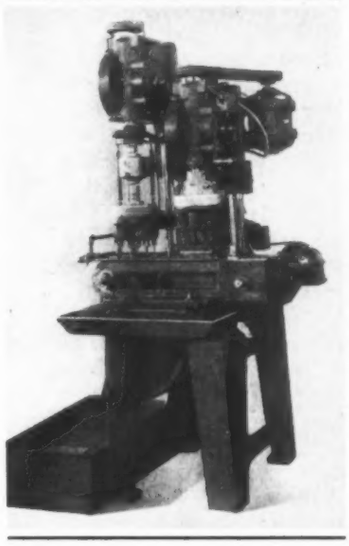
The saw blade is of the inserted-tooth type, and is 16 inches in diameter. The machine is driven by a two-horsepower motor through multiple V-belts which are enclosed by a welded steel guard. A pump, flexible tubing, and distributing nozzle are provided for delivering lubricant to the saw blade. This machine weighs about 1600 pounds.



Cochrane-Bly Metal Saw which Cuts Small Bars in Multiple

Langelier Drilling and Tapping Machine

Door-knob spindles are multiple drilled and tapped in a machine recently built by the Langelier Mfg. Co., Providence, R. I. This machine is constructed with two standard No. 21 automatic units mounted on a vertical column. The units are driven by individual motors. The unit at the right is equipped with a seven-spindle drill head, and the one at the left with a tapping head having a similar number of spindles. The tapping head is used in combination with a reversing mechanism. When the drill head starts, it operates a trip-dog on the tapping head to feed the taps to the work.



Langelier Machine for Drilling and Tapping Door-knob Spindles

The work fixture is adjustable, so that door-knob spindles having four, five, six, or seven holes can be drilled and tapped. The drilling and tapping spindles, however, are located on fixed centers, so that the center distance between holes in the work cannot be varied. Indexing is controlled through a solenoid-operated single-cycle clutch, so arranged that indexing will not take place until the heads return to their starting positions. This prevents jamming and breaking of the drills and taps.

The work is loaded into a vertical magazine and fed progressively through the drilling and tapping stations. A novel feature of the machine is a conveyor chain fitted with work-locating blocks. The chips produced in the operation are washed down through the center of the fixture. A stream of cutting fluid is directed to each tool.

Murchey Upright Roller Pipe Cutter

Pipe from 1/2 inch to 2 inches, inclusive, can be handled by the regular equipment of a Model F upright roller pipe cutter recently brought out by the Murchey Machine & Tool Co., 951 Porter St., Detroit, Mich. A cage of small rollers can be supplied as extra equipment to adapt the machine to handle pipe from 1/8 to 3/8 inch. This small cage of rollers can be placed in position without removing the standard roller cage. Pieces ranging from close nipples to long lengths can be accurately cut on a production basis. It is mentioned that 1-inch nipple blanks can be cut off at speeds as high as 700 an hour by an experienced operator, and 1/2-inch blanks as fast as 1200 an hour.

The cutter wheel is a thin heat-treated disk of tool steel which severs a pipe with a minimum burr. A simple grinding operation renews the cutting edge. The cutter-shaft occupies a fixed position, the rollers that support the pipe being raised to the revolving cutter by operating a combination hand- and foot-lever. There is an adjustable stop for limiting the motion of this combination lever and pedal in cutting short pieces which do not require the full cycle of the cam.

The pipe-supporting rollers revolve in roller bearings, so as to allow the pipe to turn freely; this is an important feature in handling heavy pieces of pipe, and it also increases the life of the cutter-wheel. The cutter-shaft runs in Timken preloaded roller bearings.

A gage arm is supported in the column of the machine, which is adjustable for all pipe diameters and lengths within the range of the machine, and can be securely clamped to insure uniform lengths. There is a handwheel that provides a means of quickly raising or lowering the roller cage to suit different sizes of pipe.

This new roller cutter, is driven by a two-horsepower motor which is mounted as an integral part of the machine. Power is transmitted directly to the cutter-wheel through an hour-glass worm. All roller cages, pipe stands, gages, etc., are interchangeable with the equipment of the Model E machine.

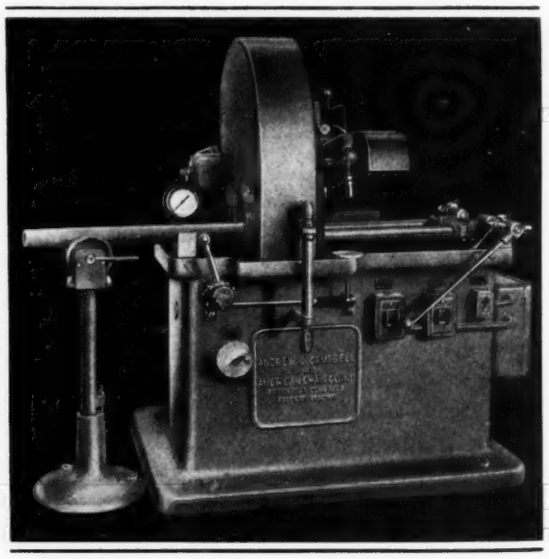
Campbell Cutamatic Abrasive Cut-off Machine

Solid stock up to 6 inches in diameter and other shapes with a maximum cross-section dimension of 6 inches can be handled by a Cutamatic abrasive cut-off machine recently developed by the Andrew C. Campbell Division of the American Chain & Cable Co., Inc., Bridgeport, Conn.

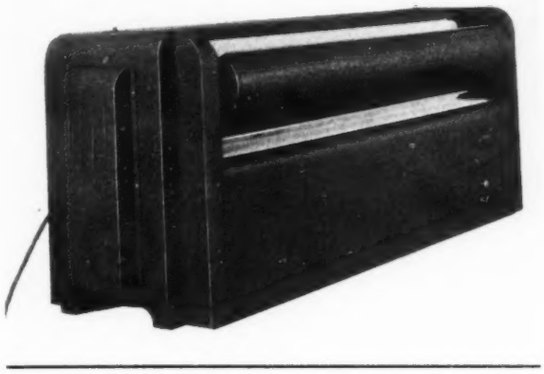
In this machine a new principle of abrasive cutting is employed, the arc of contact remaining constant in cutting any thickness of stock. This is accomplished by a combined oscillating and rotating movement of the hydraulically fed abrasive wheel. This combination of movements results in smooth true-to-size cuts having a minimum of burr, and in the elimination of burning, surface hardening, and glazing.

Another feature of this machine is the use of thin abrasive wheels. Wheels from 10 to 20 inches in diameter are used, and all of them are only 3/32 inch thick, with the exception of the 20-inch wheel, which is 1/8 inch thick. The use of thin wheels effects considerable savings in cutting large stock. Materials which are hard or soft, alloyed

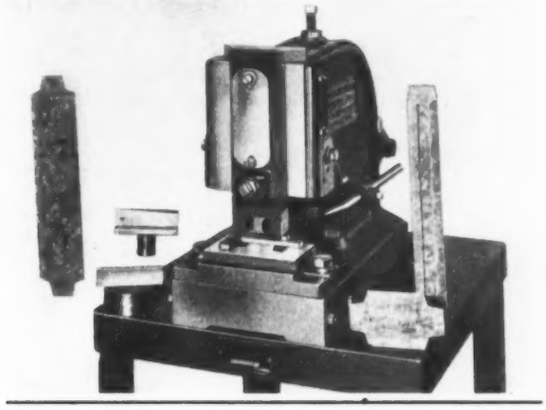
Roller Pipe Cutter of Upright Type, Built by the Murchey Machine & Tool Co.



Campbell Abrasive Cut-off Machine in which the Arc of Contact is Always the Same



Bruning Machine for Printing Black-line Prints and Blueprints



Whitney Kick Press Equipped with Notching Punch and Die

or low-carbon, can be cut, and they can therefore be purchased unannealed.

Coolant is equally distributed on both sides of the abrasive wheel to maintain an equal temperature. This insures the maintenance of a flat surface on the face of the wheel, resulting in straight cuts and reducing wheel breakage. Coolant is supplied at the rate of thirty-three gallons a minute. The method of supplying the coolant eliminates grit- and dust-laden air, and hence, the machine can be driven by a standard squirrel-cage open type motor.

All operating conditions are under the control of the machine itself, and as these conditions are predetermined for a certain type of cutting wheel, it is claimed that the machine will function satisfactorily and obtain maximum life from the abrasive wheels, regardless of the operator. Three stands for holding the material are furnished as standard equipment with this machine.

Bruning Black-Line and Blueprint Printer

A simple continuous machine for exposing BW black-line paper or blueprint paper is a recent development of the Charles Bruning Co., Inc., 102 Reade St., New York City. This machine, which is built for operation at 100-volt alternating current and 110-volt direct current, handles paper of any width up to and including 42 inches. It can be operated at low cost from any light socket.

When used in conjunction with the Bruning black-and-white developing machine, this printer provides a simple means of producing black-line prints from tracings or drawings. The prints do not require washing or drying.

New Set of Johansson Precision Gage-Blocks

A new No. 2 set of precision gage-blocks which is sold at a price somewhat less than that of the present No. 2 set is being introduced to the trade by the Johansson Division of the Ford Motor Co., Dearborn, Mich. The new set is additional to the present No. 2 set, and is the same as the latter, except for four accessories consisting of two jaws and two adjustable holders. The gage-blocks are of B, A, and AA qualities, accurate to within plus or minus eight-, four- and two-millionths of an inch, respectively.

The thirty-five gage-blocks of the new set provide 80,000 different size measurements in steps of 0.0001 inch. The gage-blocks of this set can, of course, be used alone, but they will also be useful in shops already equipped with adjustable holders and jaws, but that are in need of more blocks.

Whitney Notcher and Bending Brake

The Whitney Metal Tool Co., Rockford, Ill., has developed a notching punch and die for application to the No. 28 kick press, as shown in the illustration. This die set is for producing drive cleats used in fastening sections of sheet-metal duct together. The punch and die cut two tapered notches at the end of the galvanized stock in one operation, as shown, after which the sides are folded in by other means to form the finished cleat. The right-hand punch is of extra width to compensate for slight variations in the width of the blank stock. Guides insure proper positioning of the blanks for punching.

The illustration also shows a shearing punch and die designed for cutting off straight stock to required lengths. This punch and shear can easily be substituted for the notching unit.

The same concern has also added an 18-gage combination bending brake to the Whitney-Jensen line, which has been previously described in MACHINERY. These brakes are now available in 5-, 6-, 8-, and 10-foot sizes for handling any thickness of sheet metal up to No. 18 gage. Box- and pan-bending can be performed, as well as all types of straight bending. The company also builds a 4-foot portable brake for 20-gage sheets.

"Knock-Out" Keyless Drill Chucks

Chucks designed to meet the requirements of heavy-duty, precision, and high-speed drilling have been placed on the market in a line comprising five sizes by the K. O. Lee & Son Co., Aberdeen, S. D. These sizes have capacities from 0 to 1/4 inch, 0 to 3/8 inch, 0 to 1/2 inch, 3/16 to 5/8 inch, and 1/4 to 7/8 inch.

One of the features claimed for these chucks is that they are slip-proof, and therefore eliminate all spoilage and "chewing" of drill shanks. The grip on the drill shank is automatically tightened in proportion to the resistance encountered in an operation. Another feature is that the chucks are keyless, no wrenches, keys, or other tools being required for their operation. A slight fingertip twist of the feed-screw cap is said to be sufficient to grip a drill.

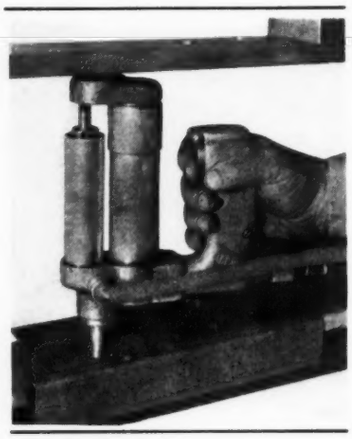
The jaws and cone are designed for permanent alignment, and all parts contributing to accuracy and durability are hardened and ground. The working parts are permanently lubricated, so as to prolong their life. The chucks have a fast action, being equipped with a feed-screw of steep pitch and square-cut threads. Only a few turns of the cap are required to adjust a chuck through its full range. The ball-bearing construction insures free action and easy release, even after severe heavy-duty drilling.

Lee Keyless Drill Chuck

Cableless Hydraulic Spot-Welding Gun

A portable spot-welding gun that is particularly convenient to use because it does not require electric conductor cables has been brought out by the Progressive Welder Co., 737 Piquette, Detroit, Mich. A pressure bar installed above the welding table, as illustrated, serves also as an electrical conductor bar. The table provides the other lead to the transformer. The transformer and booster are built into a fixture for compactness.

Hydraulic pressure insures proper contact of the parts to be welded, and a "Non-Beat" automatic timing arrangement prevents the electric welding cycle from being completed until the parts are pressed close together. The off-center mounting of the piston reduces arcing and flaring at the welding points and thus prolongs their life. For use with production fixtures, this gun can be equipped with various points and adapters. Different handles and grips can be supplied.

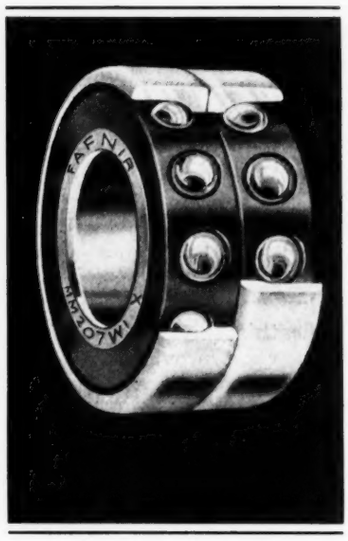


Spot-welding Gun Operated by an Overhead Pressure and Conductor Bar

Fafnir Ball Bearings for High-Speed Grinding Equipment

Ball bearings designed primarily for use in high-speed grinding equipment have been added to the X type duplex line manufactured by the Fafnir Bearing Co., New Britain, Conn., which was described in December, 1936, MACHINERY. These bearings are intended for shaft speeds ranging from 5000 to about 40,000 revolutions per minute, and it is said that a life of from 2000 to 3000 hours has been regularly obtained in such service, in spite of unusual load and speed requirements.

These bearings have been termed "Extreme Precision" by the manufacturer, because the balls are checked within 0.00001 inch on an electro-limit gage, while the permissible tolerance on the bore diameter is 0.0001 inch, and on the outside diameter 0.0002 inch. The bearings are preloaded at the time of assembly. They are equipped with light but sturdy composition retainers that are especially suitable for high-speed service.



Fafnir Duplex Ball Bearing

Noble & Westbrook Micrometer-Dial Graduating Machine

Graduations and figures are rolled on micrometer dials and other machine tool parts in one operation by the machine here illustrated, which was recently built by the Noble & Westbrook Mfg. Co., 15 Westbrook St., East Hartford, Conn. This machine is similar to models previously built by the concern, but it accommodates a larger range of work and is more easily operated.

The work-spindle is mounted in roller bearings, and is removable, so that different types of spindles can be conveniently used. The work and spindle are geared to the marking die, in order to hold the zero-line location and insure accuracy of the graduations. The marking die turns on a stationary shaft which can be adjusted laterally for positioning the marking. Fine or wide graduations can be made, and they can be rolled to any desired depth, depending upon the number of revolutions made by the marking die over the work.

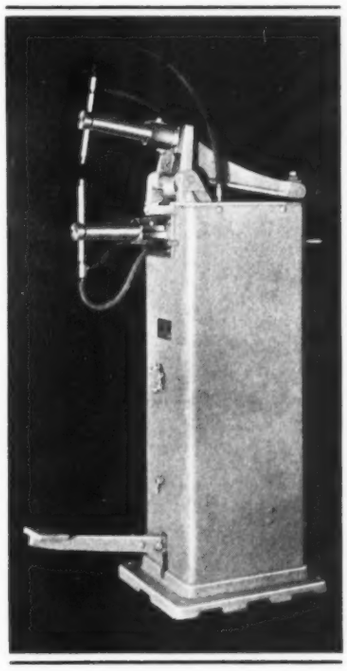
Pressure is applied by a foot-treadle to bring the marking die against the work. Micrometer dials and similar parts up to about 8 inches in diameter can be handled. The machine is heavier than previous models.

Machine for Graduating Micrometer Dials

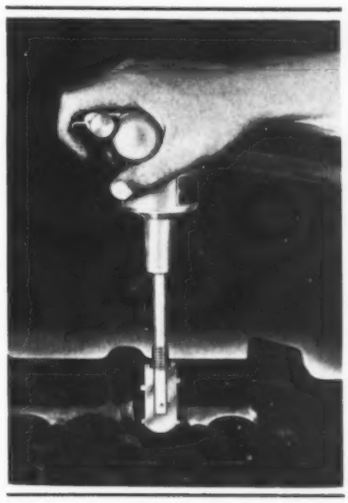
Agnew Foot-Operated Spot-Welder

A Model J foot-operated spot-welder of simplified design has been placed on the market by the Agnew Electric Co., Milford, Mich., for all-around application. This machine is constructed with an all-steel body and a cast-iron base and top plate. It has a rating of 10 kilovolt-amperes, which provides sufficient capacity for welding two pieces of No. 16 gage material. The standard throat depth is 8 inches, but machines can be built with throat depths up to 18 inches.

An adjustable automatic switch insures welds of high quality, and there are four points of heat regulation. Elkaloy water-cooled electrodes are supplied.



Foot-operated Spot-welder for All-around Work



Pneumatic Grinder for Producing Compression-tight Valve Seats

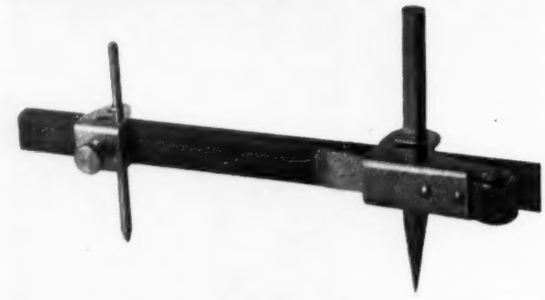
Aldon Pneumatic Valve Grinder

A pneumatic valve grinder designed for use on internal combustion engines and industrial valves of the poppet and plug type is being introduced to the trade by the Aldon Products Co., 1950 High St., Duncannon, Pa. In the application of this grinder, the valve is oscillated rapidly back and forth, and at the same time, moved forward one-sixth of a revolution per stroke. It is thus being turned continuously through a full 360 degrees and eliminates high spots and valleys on the valve contact surfaces. This roto-oscillating action is obtained through a positive clutch arrangement for which patent applications have been made.

The grinding speed is instantly adjustable from 600 to 6000 strokes a minute. A trigger finger control is provided. The tool can be operated from a small air compressor.

Baker-Raulang Industrial Truck Controller

A new development in controllers for industrial trucks has been brought out by the Baker-Raulang Co., Cleveland, Ohio, under the trade name "NoPlug"



Beam Compass with Quick Adjustment for the Pencil or Ruling Pen

Micrometer Provided with Carboloy Tips on the Anvil and Spindle

controller. This controller makes careful operation of industrial trucks to which it is applied compulsory. It prevents starting from a dead stop in third speed or throwing in the controller from full-speed ahead to full reverse without stopping the truck. As a great deal of the maintenance cost of industrial trucks is directly traceable to operating them in this manner, causing great overloads and sudden reversals of stresses, considerable savings are expected to be realized by means of the new type of control. Not only are maintenance costs and time-out for repairs reduced, but longer life of both the truck and battery is assured.

Bartusch Beam Compass

Unusual rigidity and quick adjustment are features claimed for the beam compass here shown, which is being placed on the market by A. P. Bartusch, 775 Walnut St., Lockport, N. Y. This beam compass is designed to use a standard pencil or ruling pen, but a ruling pen of smaller diameter can be rigidly clamped by swiveling a pressure plate through one-half turn.

Adjustments for radius are made simply by propelling the roller of the pen and pencil holder along the beam. The smallest radius to which the compass can be set is 1 3/8 inches. Beams 12, 24, and 36 inches long can be supplied.

Carboloy Tips for Micrometers

Carboloy Company, Inc., 2987 E. Jefferson Ave., Detroit, Mich., has announced a micrometer tipping service that is available to all micrometer users. By means of this service, a micrometer can be sent to the company to be equipped with Carboloy cemented-carbide tips on the anvil and end of the spindle, so as to make these surfaces practically wearless. The micrometer is then accurately adjusted and returned to the owner ready for use. One standard price has been established for tipping all micrometers, regardless of size.

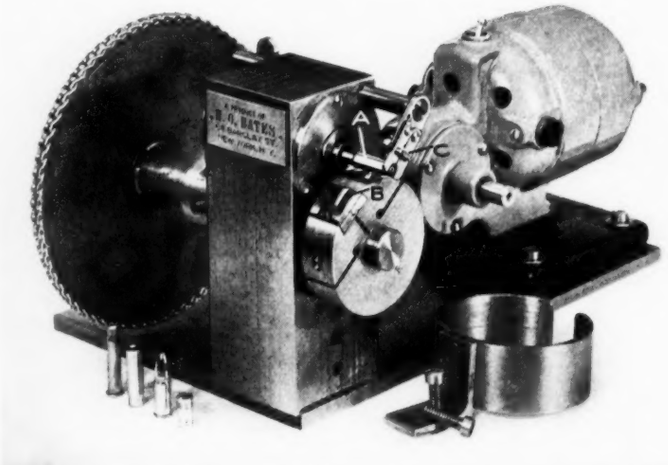


Fig. 1. Semi-automatic Marking Machine Built by H. O. Bates

H. O. Bates Roto-Marker

A semi-automatic motor-driven machine that can be operated from any light socket for marking numerals, letters, etc., on shells, caps, ferrules, and other tubular parts has been developed by H. O. Bates, 68 Barclay St., New York City. In the operation of this machine, which is illustrated in Fig. 1, the work is slipped on an arbor *A* and is neatly marked as the characters on die *B* are rolled into contact with it.

The part is then automatically ejected by fingers *C*, which during the marking are withdrawn close to the housing of the machine. This automatic ejector discharges each marked part in time to allow about a three-quarter turn of the roll on which

Fig. 2. Parts Marked on the Machine in Fig. 1

the die is mounted; this gives the operator sufficient time to load a new piece on the arbor. The parts illustrated in Fig. 2 are marked at the rate of approximately fifty pieces per minute, hand-fed. Equipped with an automatic loading arrangement, it is estimated that 150 or more parts of the same size could be marked per minute.

The marking die is held in a dovetail clamp from which it can be quickly released for changing dies. Two or more dies can be assembled in the roll at one time. The part being marked rotates freely with the roll.

This machine can be built in various sizes for marking parts ranging from pencil caps to five-gallon ice-cream cans or ten-gallon milk cans having a neck and shoulder. By making simple modifications, the machine can also be adapted for marking solid round pieces, such as screw machine products, drills, and various other types of rotary cutters.

Universal Metal Spray Gun

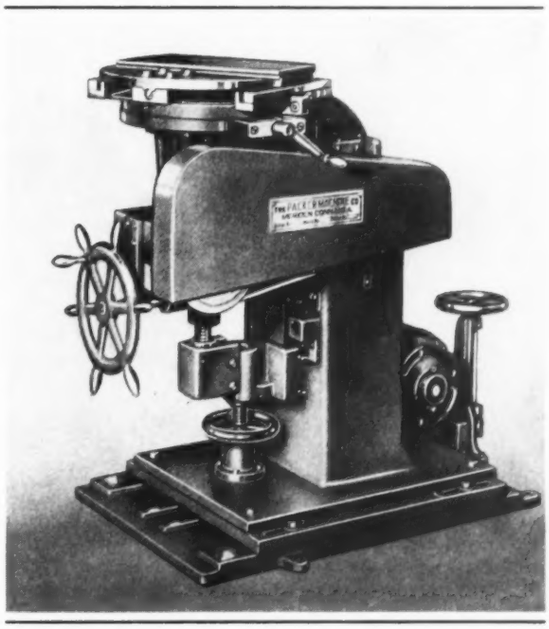
A metal spray gun that will handle all metals in any size of wire up to 1/8 inch has recently been placed on the market by the Metalspray Co., Inc., 113 Llewellyn St., Los Angeles, Calif. In general appearance, this gun resembles the one described in August, 1934, MACHINERY, page 763, which, however, was made in two sizes to suit different wire diameters. The new gun weighs less than four pounds, and is equally convenient for hand or lathe use.

A single control valve of Monel metal and bronze construction permits turning on acetylene, oxygen, and air simultaneously. In addition, there are independent valves for the adjustment of the acetylene and oxygen. An air-ventilated nozzle eliminates backfire. Metals with a melting point up to 4800 degrees F. can be handled. Deposits can be made in thicknesses from 0.001 to 1 inch.

Packer Vertical Portable Polishing and Buffing Machine

A vertical type of polishing machine that is especially advantageous for buffing the inside surfaces of hollow-ware products, such as bread trays and vegetable and salad dishes, has been developed by the Packer Machine Co., Meriden, Conn. This machine is regularly equipped with an oval chuck having a maximum diameter of 21 inches. Work-holding fixtures can be attached to the top surface of this chuck.

Longitudinal adjustment of the stand, as well as raising and lowering of the chuck for loading and unloading the work, is accomplished through hand-wheels. There is also a crank-handle which permits adjustment of the eccentric setting of the chuck. The machine is driven by a totally enclosed dustproof ball-bearing motor of 1 1/2 horsepower rating.



Packer Vertical Polishing and Buffing Machine

Lincoln Electrode for Fillet Welding

An electrode that eliminates the necessity of making a multiple number of passes in the production of fillet and lap welds and that enables such welds to be produced without under-cutting or overlap has been announced by the Lincoln Electric Co., Cleveland, Ohio. Fillet welds up to 3/8 inch in size, with one plate vertical, can be produced in one pass with this electrode, which has been termed "Fleetweld 8."

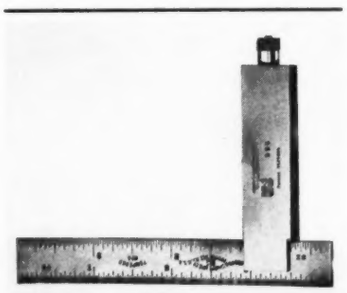
This electrode is heavily coated for welding by the shielded arc process. The tensile strength of the weld metal as deposited is from 68,000 to 72,000 pounds per square inch. The elongation in two inches ranges from 20 to 30 per cent as deposited, and from 30 to 36 per cent when the work has been stress-relieved. The resistance of the electrode to fatigue, impact, or corrosion is equal to or better than that of mild steel.

This electrode is available in 14- and 18-inch lengths and in various diameters from 5/32 to 3/8 inch. It is especially suitable for use in ship, bridge, and building construction, and in manufacturing processes.

Wagner Motor of Resilient-mounted Design

rings of rubber are vulcanized to inner and outer steel rings on the base. The motor is locked in place in the cradle arms by means of latches and nuts. It can be easily removed from the base when necessary.

These motors are also available with belt-tightener bases to meet the requirements of refrigerators and small belt-driven appliances. With these bases, the belt tension increases as the load increases, and thus belt slippage is prevented.



B & S Adjustable Square with Blade of Increased Length

Wagner Annular Type Resilient-Mounted Motors

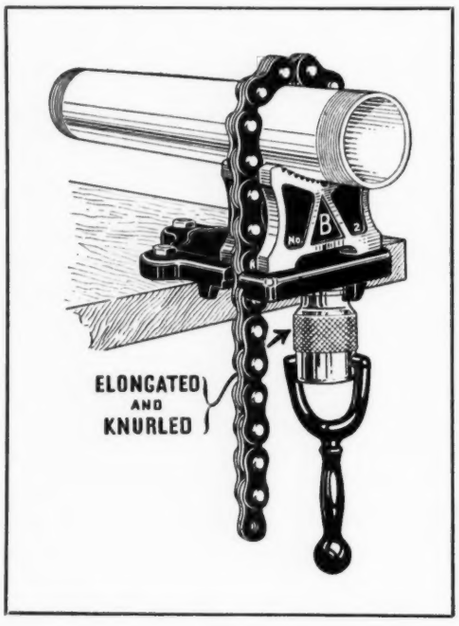
Annular resilient mountings are now available for repulsion-start-induction split-phase, capacitor, and polyphase motors of fractional horsepower manufactured by the Wagner Electric Corporation, 6467 Plymouth Ave., St. Louis, Mo. Rubber mounting supports absorb the vibration of these motors as close to the shaft center as possible.

As will be seen from the illustration, the motor base is made of rolled sheet steel and is in the form of a cradle. Large

Billings & Spencer Chain Pipe Vise

An improved chain pipe vise has been placed on the market by the Billings & Spencer Co., Hartford, Conn. One of the construction features of this vise is a heavily knurled and elongated adjustment nut which provides a gripping surface for rapidly taking up slack in the chain. A partial turn of the handle is sufficient to clamp a pipe. There is no interference between the handle and the bench.

This improved chain pipe vise is made entirely of steel, the base, handle and jaws being drop-forged to obtain light weight and maximum strength. The jaws are made from a special-analysis tempered steel, while the chains are heavily constructed. This vise is made in four sizes with capacities for pipe from 1/8 inch to 8 inches.



Billings & Spencer Chain Pipe Vise of Improved Construction

Brown & Sharpe Adjustable Square with 4-Inch Blade

A No. 555 adjustable square with a tempered blade 4 inches long has been added to the products of the Brown & Sharpe Mfg. Co., Providence, R. I. A blade of this length makes the adjustable square suitable for many classes of toolroom work for which squares with shorter blades are inadequate. The beam is 2 7/16 inches long, and is hardened and ground.

IXL Hygrade Worm-Gear Speed Reducer

The Foote Bros. Gear & Machine Corporation, 5319 S. Western Blvd., Chicago, Ill., announces the addition of a Size 7HG to the line of IXL Hygrade worm-gear speed reducers. This reducer has a center distance of 7 1/4 inches, and is available with ratios ranging from 3 7/8 to 1 up to 2450 to 1. Horsepower ratings range from 1/2 to 27 1/2 horsepower in the single-reduction type, and output torque ratings range from 12,600 to 21,000 inch-pounds in the double-reduction type. Horizontal and vertical styles are available.

With the new size, this line of speed reducers covers a total capacity range of from 0.06 to 200 horsepower in single-reduction types and corresponding capacities in double-reduction types.

Tagliabue Photo-Electrically Balanced Potentiometer

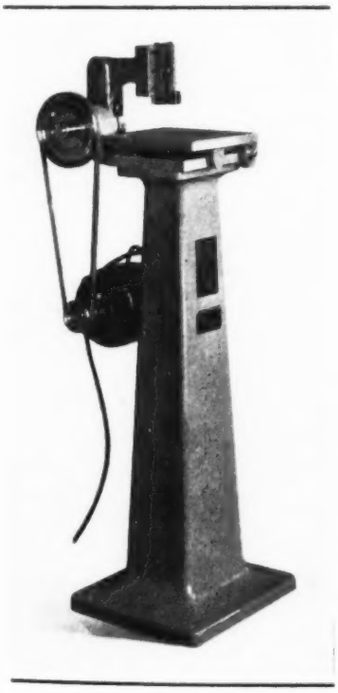
The C. J. Tagliabue Mfg. Co., Park and Nostrand Aves., Brooklyn, N. Y., has brought out a new Celectray recording potentiome-

ter, in which a sensitive mirror galvanometer is the primary controlling element and an inertialess beam of light takes the place of the customary pointer. The beam of light, in moving on and off a photo-electric tube, operates relays, which, in turn, control a reversing motor that drives the moving contact of the Wheatstone bridge or potentiometer. The photo-electric tube is not a calibrated element, serving only to detect the direction of the light beam and bringing the galvanometer to zero deflection according to the null method of balancing an electric circuit.

A high-current sensitivity is available, permitting the use of high resistance or of long thermocouple leads without material loss of accuracy in the balancing. Simplicity, accuracy, and speed are advantages claimed.

Brickner-Kropf Filing and Lapping Machine

A filing and lapping machine designed primarily for the finishing of shoulder punches, but which is applicable to a variety of work, has been placed on the market by the Brickner-Kropf Machine Co., Inc., Muskegon Heights, Mich. The overhead construction of this machine enables work to be brought close to the tool chuck, thus increasing the accuracy of the equipment and reducing the breakage of fragile tools. The file-holder can be quickly removed from the work without disturbing any adjustment.



Brickner-Kropf Filing and Lapping Machine

The table and head are both of the tilting type. Vertical adjustments can be made without any change in alignment. Double-angle bearings are provided on the steel slide. The rocker-arm pin is hardened and ground and is provided with two rows of needle bearings, while the drive-shaft and head, which are made in one piece, are equipped with ball bearings.

The important specifications of this machine are as follows: Dimensions of table, 8 3/4 by 9 inches; distance from table to head, 3 inches; stroke, from 0 to 1 inch; and adjustment of file-holder, 3 1/2 inches. The machine, as regularly supplied, is intended to be run at a shaft speed of 700 revolutions per minute, but a slower speed can be provided for if desired.

* * *

Automobile Sales High in Spite of Strikes

Although hampered by labor difficulties, the members of the Automobile Manufacturers Association sold over 350,000 cars and trucks in March, according to a report by the Automobile Manufacturers Association. This was the highest March volume for the Association members since 1929, exceeding the shipments for March last year by 7 per cent. The sales of the Association members, who include every important automobile manufacturer except Ford, amounted to about 864,000 cars and trucks during the first quarter of 1937—an increase of 5 per cent over the corresponding period last year, when the sales reached 824,000 cars and trucks.

General Electric Machine Tool Speed Show

The General Electric Co., Schenectady, N. Y., is making a traveling presentation of the latest electric equipment for machine tool application in what is known as the General Electric Machine Tool Speed Show. The first presentation will be made at Hotel Bancroft in Worcester, Mass., May 17. Other cities to be visited by the show are Cincinnati, on May 24, and Rockford, Ill., on May 28.

The Worcester show, to which New York and New England machine tool builders have been invited, will last a full day. It will stress the importance of higher production speeds with greater accuracy. It will open with a sound motion picture of modern machines in operation and includes the presentation of papers by leading machine tool manufacturers and General Electric engineers. It will also include an exhibit of new electric equipment for machine tool service, as well as a presentation by the Carboloy Company.

* * *

Details on Lincoln Arc-Welding Competition

The James F. Lincoln Arc Welding Foundation, Cleveland, Ohio, has issued a booklet containing detailed information on the rules and conditions governing the $200,000 prize contest for the best papers on applications of electric welding to product design and construction, announced in March MACHINERY, page 475. This contest should be of great benefit to the entire machinery manufacturing industry. It is more truly a machinery manufacturing contest than just an arc-welding contest. The first prize winner will receive $13,700, and the other prizes range from $7500 down to $100. The contest closes June 1, 1938. Machinery manufacturing executives, machine designers, mechanical engineers, and production managers have already shown considerable interest in this contest.

NEWS OF THE INDUSTRY

California and Washington

H. M. HALL, 108 W. 6th St., Los Angeles, Calif., has been appointed representative for the southern part of that state of the BODINE ELECTRIC CO., Chicago, Ill. J. A. NADON, who formerly represented the company in the entire state of California, has found it necessary to confine his activities to the northern part of the state due to increasing business.

CAMPBELL HARDWARE & SUPPLY CO., 108-110 First Ave., S., at Yesler, Seattle, Wash., has been appointed distributor in Seattle and vicinity for the line of stock gears, sprockets, speed reducers, and flexible couplings manufactured by the Charles Bond Co., of Philadelphia, Pa. These products will be kept in stock.

Illinois, Indiana, and Michigan

BERNARD E. SUNNY and JAMES S. WATSON were elected directors of the Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill., to serve until 1941, at the annual meeting of stockholders. Mr. Watson is vice-president in charge of the Indianapolis plant operations of the Link-Belt Co., and has served the company continuously for forty-four years. STAUNTON B. PECK and HARRIS WHITTEMORE, JR., were re-elected directors for the same term.

James S. Watson, Newly Elected Director of the Link-Belt Co.

J. B. TROTMAN, who has been associated for many years with Goulds Pumps, Inc., has been appointed manager of the T-Pump Division of the Roots-Connersville Blower Corporation, Connersville, Ind.

CHARLES RUTLEDGE has been appointed service representative for the Detroit district of the American Foundry Equipment Co., 555 S. Byrkit St., Mishawaka, Ind. Mr. Rutledge's headquarters will be with Hutton H. Haley & Associates, 2918 E. Grand Blvd., Detroit, Mich.

Massachusetts

PORTER-MCLEOD MACHINE TOOL CO., INC., Hatfield, Mass., has purchased the assets and good will of the HIGLEY MACHINE CO., manufacturer of cold metal sawing machines. The Porter-McLeod Machine Tool Co. has been engaged in the manufacture of standard lathes for many years. It will continue to build the more recent models of Higley cold metal sawing machines and is at present making some changes in the design to make the appearance conform with the modern trend.

Missouri and Oklahoma

DON MCCORMICK has been appointed arc-welding consultant for the Kansas City, Mo., office at 1818 Main St., of the Lincoln Electric Co., Cleveland, Ohio. Mr. McCormick was formerly welding supervisor for the Sheffield Steel Co. of Kansas City, and has had broad experience in the practical application of electric welding.

BRAMMER MACHINE & TOOL SERVICE CO., Tulsa, Okla., has been appointed exclusive representative in the Oklahoma territory for the Murchey Machine & Tool Co., 951 Porter St., Detroit, Mich., manufacturer of threading tools and machines.

New Jersey

MONARCH MACHINE TOOL CO., Sidney, Ohio, announces the removal of its New York office to 1060 Broad St., Newark, N. J., effective May 1.

ROLAND W. BURT has been appointed eastern manager of railroad sales for Joseph T. Ryerson & Son, Inc., with headquarters at the Jersey City office of the concern. Mr. Burt has been connected with the Ryerson organization for fourteen years, having been advanced through the various sales divisions to the position of sales representative in the state of Indiana. He has had many years of experience in the steel industry.

Roland W. Burt, Eastern Manager of Railroad Sales, Joseph T. Ryerson & Son

H. O. HARTDEGEN, sales engineer for the Driver-Harris Co., Harrison, N. J., has been placed in charge of the territory consisting of northern New York and eastern Pennsylvania. He will also handle some accounts in the New Jersey territory. This territory was formerly assigned to J. B. SHELBY, who has now been advanced to the management of the foundry division, where he will act as co-manager with J. SAMMON.

New York

W. H. BORST and E. A. WEBBER have joined the sales staff of the New York office, at 330 W. 42nd St., of the Lincoln Electric Co., Cleveland, Ohio. Mr. Webber was formerly connected with the Chicago office of the company. The new men will assist the members of the New York office staff in providing welding consultation service on all phases of welding, in addition to filling orders for welding machines, electrodes, and supplies.

H. A. WINNE, manager of sales of the mining and steel mill section of the industrial department of the General Electric Co., Schenectady, N. Y., has been transferred to the engineering department as general assistant to R. C. Muir, vice-president in charge of engineering. He has been succeeded by J. J. HUETHER, present manager of sales in the machinery manufacturers' section. S. W. COEBIN will succeed Mr. Huether.